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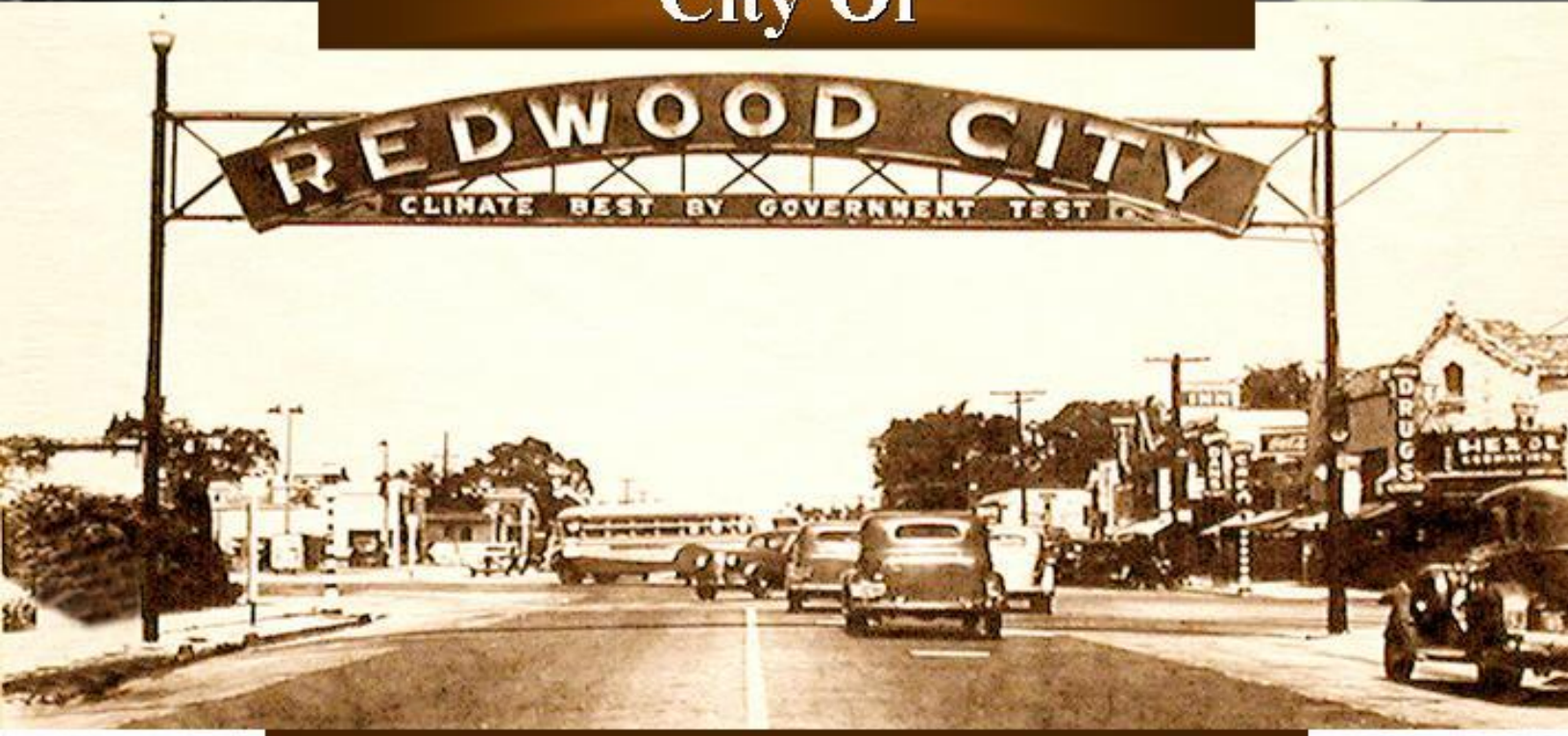

Emergency Operations Plan

May 2006

ENGINE No. 1

Alarm & Dispatch Office

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EXECUTIVE SUMMARY

This is the Local Hazard Mitigation Plan for the City of Redwood City. The Disaster Mitigation Act of 2000 (DMA) was passed by Congress to emphasize the need for mitigation planning to reduce vulnerability to natural and human-caused hazards. DMA 2000 amended the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act; 42 United States Code 5121 et seq.) by repealing the act's previous Mitigation Planning section (409) and replacing it with a new Mitigation Planning section (322).

To implement the DMA 2000 planning requirements, the Federal Emergency Management Agency (FEMA) established mitigation planning requirements for states, tribes, and local communities, including the requirement to develop a Local Hazard Mitigation Plan (LHMP) to address known natural hazards that impact the City of Redwood City.

The City of Redwood City Local Hazard Mitigation Plan (LHMP) includes resources and information to assist City residents, public and private sector organizations, and others interested in participating in planning for natural hazards. This LHMP provides a list of activities that may assist Redwood City in reducing risk and preventing loss from future hazard events. The action items address multi-hazard issues, as well as activities for earthquakes, earth movements (landslide), flooding, and wildfires. While we cannot predict or protect ourselves against every possible hazard that may strike the community, we can anticipate many impacts and take steps to reduce the harm they will cause. This LHMP starts an ongoing process to evaluate the risks different types of hazards pose to the City, and to engage the City and the community in dialogue to identify which steps are most important to pursue to reduce these risks.

The Plan contains a background on the purpose and methodology used to develop the mitigation plan, a profile of Redwood City, sections on hazards that occur within the City, and a number of appendices. All of the sections are described in Section One, Background.

The City and community members have been working together for years to address certain aspects of the risk – such as strengthening infrastructures, establishing emergency preparedness plans, and enforcing vegetation management measures in the urban-wildland interface zones. This Plan will formalize this process and make sure that these activities continue to be explored and improved over time. Over many years, this constant focus on disasters will make the city, its residents and businesses, much safer.

This Plan meets the requirements of the federal DMA 2000, which calls for all communities to prepare mitigation plans. By preparing this plan, the City of Redwood City is eligible to receive federal mitigation funding after disasters and to apply for mitigation grants before disasters strike.

As part of developing this Plan, detailed research was conducted on the four major natural hazards that threaten the City of Redwood City. These hazards are earthquakes, wildfires, landslides and floods. The two hazards that are most likely to cause significant damage in the City are earthquakes and wildfires.

This LHMP promotes sound public policy designed to protect citizens, critical facilities, infrastructure, private property, and the environment from natural hazards. This can be achieved by increasing public awareness, documenting the resources for risk reduction and loss-prevention, and identifying activities to guide the City towards building a safer, more sustainable community.

Nothing in this Plan is intended to, nor shall, create a mandatory or other duty for the City of Redwood City, its officers or employees, including a duty to inspect, take action, or otherwise.

It is further acknowledged and accepted that the City of Redwood City has other adopted plans, policies, and regulations, including but not limited to the Zoning Code and its regulations, the General Plan, and several Specific and Precise Plans, that regulate where and how development will occur in the sound exercise of the City's discretion. This Plan is not intended to, and shall not, supersede other adopted plans, policies, and regulations, nor supersede the judgment of the City, its officers and employees; and conflicts between this Plan and other documents shall be resolved in favor of those other adopted documents unless the City in its judgment determines otherwise.

As part of this LHMP, the City Council is required to formally adopt the LHMP in the form of a City Council Resolution (See Appendix 1).

PLAN OVERVIEW

This Local Hazard Mitigation Plan (LHMP) for the City of Redwood City consists of six sections:

Section 1 – Jurisdiction Background
Section 2 – Planning Process
Section 3 – Rick Assessment
Section 4 – Mitigation Strategy
Section 5 – Plan Maintenance Process
Section 6 – References

Sections 1 – 6 are described below.

Section 1 - Background

Section 1 provides a background on the City of Redwood City.

Section 2 - Planning Process

Section 2 describes the planning process, identifies the Hazard Mitigation Team members and the key stakeholders within the community and surrounding region. In addition, this section documents public outreach activities and the review and incorporation of relevant plans, reports, and other appropriate information.

The City of Redwood City Local Hazard Mitigation Plan (LHMP) is the result of a collaborative effort between Redwood City citizens, public agencies, non-profit organizations, the private sector, and regional and state organizations. Public participation played a key role in development of goals and action items. Interviews were conducted with stakeholders across the City, and a public workshop was advertised and held to include City of Redwood City residents in plan development. A project Steering Committee guided the process of developing the plan. The Steering Committee was comprised of representatives from:

- City of Redwood City Emergency Preparedness (Fire Department)
- City of Redwood City Community Development Department
- City of Redwood City Public Works Department
- California Emergency Management Agency
- Local Consultants
- Community Members

Section 3 - Risk Assessment

Section 3 describes the process through which the Hazard Mitigation Team identified and compiled relevant data on all potential natural hazards that threaten the City and the immediate surrounding area.

Section 4 - Mitigation Strategy

As Section 4 describes, the Hazard Mitigation Team developed a list of mitigation goals, objectives, and actions based upon the findings of the risk assessment and the capability assessment. Based upon these goals and objectives, the Hazard Mitigation Team reviewed and prioritized a comprehensive range of appropriate mitigation actions to address the risks facing the community. Such measures include preventive actions, property protection techniques, natural resource protection strategies, structural projects, emergency services, and public information and awareness activities.

In addition, Section 4 identifies potentially vulnerable assets such as people, housing units, critical facilities, and infrastructure. This data was compiled by assessing the potential impacts from each hazard using a Geographic Information System (GIS) and FEMA's natural hazards loss estimation model, HAZUS-MH. The resulting information identifies the full range of hazards that the City could face and potential social impacts, damages, and economic losses.

Section 5 - Plan Maintenance Process

Section 5 describes the Hazard Mitigation Team's formal plan maintenance process to ensure that the LHMP remains an active and applicable document. The Plan Maintenance Section of this document details the formal process that will ensure the City of Redwood City LHMP remains an active and relevant document. This section describes how the City will integrate public participation throughout the plan maintenance process. Finally, this section includes an explanation of how the City government intends to incorporate the mitigation strategies outlined in this Plan into existing planning mechanisms such as the City's General Plan. The process includes monitoring, evaluating, and updating the LHMP; implementation through existing planning mechanisms; and continued public involvement.

Section 6 - References

Section 6 lists the reference materials used to prepare this LHMP.

SECTION 1 – JURISDICTION BACKGROUND

City Overview

Redwood City is located on the San Francisco Peninsula in the San Francisco Bay Area of California. Redwood City is the county seat of San Mateo County. According to the United States Census Bureau, the city has a total area of 34.6 square miles, of which 19.5 square miles is land and 15.1 square miles (43.66%) is water. A major watercourse draining much of Redwood City is Redwood Creek, to which several significant sloughs connect, the largest of which is Westpoint Slough. The City is also home to the Port of Redwood City, the southernmost deep water Port in the San Francisco Bay. As of the census of 2008, there were 75,508 people, 27,423 households, and 17,898 families residing in the city. The population density was 4,871.3 people per square mile. There were 29,194 housing units at an average density of 2,484.8/sq mi.

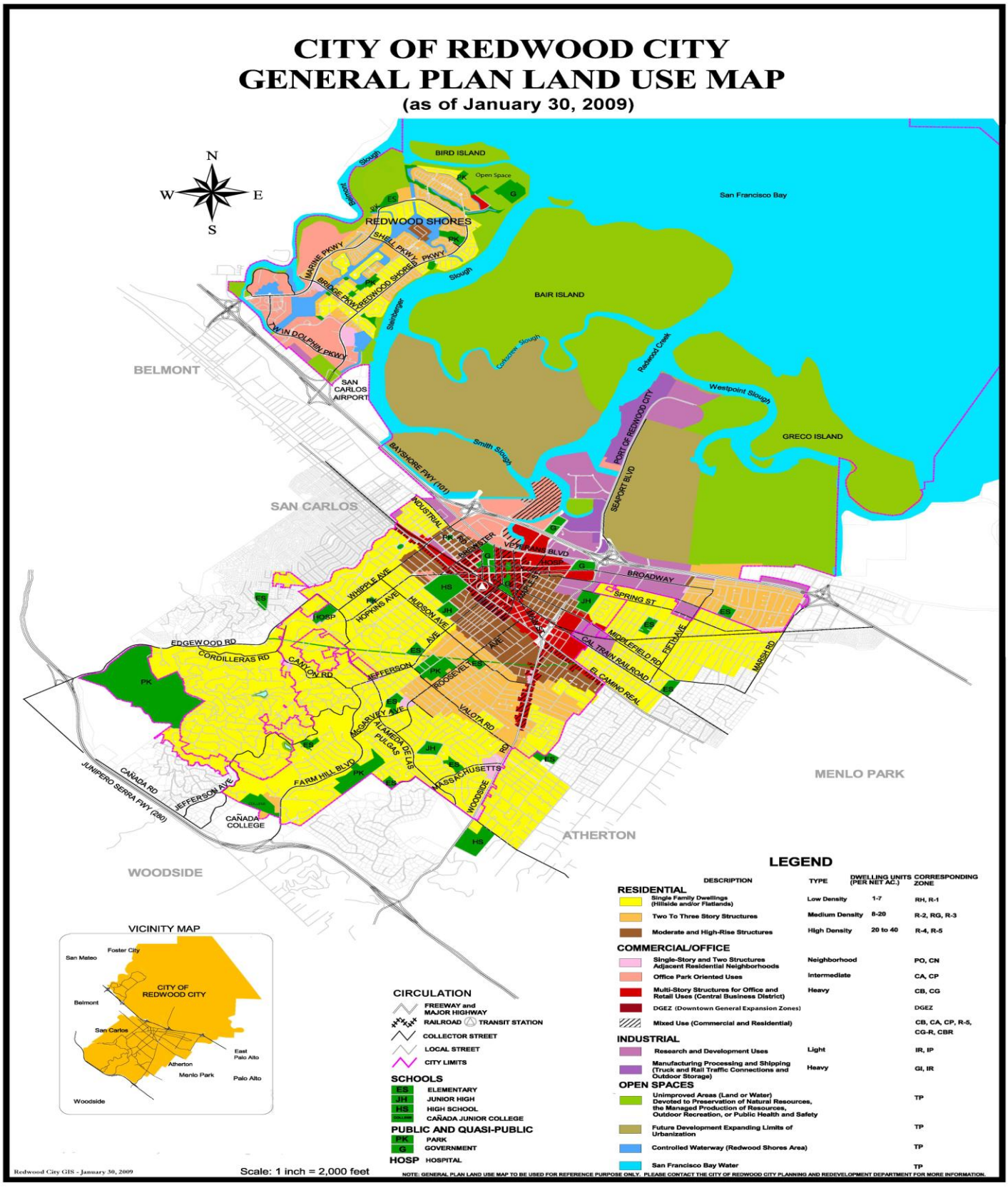
Redwood City's sphere of influence includes the districts of Emerald Lake Hills and North Fair Oaks, which, however, are largely outside the city boundaries and are counted individually for the U.S. census. Palomar Park, just north of Emerald Hills and east of the City of San Carlos' Crestview area, is another Redwood City neighborhood that is formally part of unincorporated San Mateo County. The neighborhood of Redwood Shores is part of Redwood City, although it is not possible to travel by road from one to the other without passing through the neighboring city of San Carlos (See Figure O-1).

El Camino Real, a northwest/southeast arterial street and Woodside Road, a north-northeast/south-southwest arterial, run through Redwood City. Locally, the former is regarded as north/south and the latter east/west, as El Camino connects Redwood City to San Francisco and San Jose and Woodside Road runs from San Francisco Bay to the Santa Cruz Mountains. State Highway 101 traverses the City from North/South and also connects the City to San Francisco and San Jose.

Infrastructure

Redwood City’s largely unseen infrastructure keeps the City running smoothly. Water storage and distribution system is safe and well−maintained. Recycled water service area is expansive, and the City is a regional leader in facilitating recycled water use. Wastewater is minimized with conservation, and the City continues to meet public health and wastewater treatment needs. Redwood City facilitates alternative and renewable energies, which have become a primary portion of its energy portfolio. Utility lines run underground, preserving community aesthetics while supporting business and residence communications and function.

Figure 1-1 City of Redwood City General Plan Land Use Map



Redwood City obtains all of its potable water from the San Francisco Public Utilities Commission (SFPUC) through the Hetch Hetchy regional water system. The supply is predominantly from the Sierra Nevada, delivered through the Hetch Hetchy aqueducts, but also includes treated water produced by the SFPUC from its local watersheds and facilities in Alameda and San Mateo Counties. These facilities include Calaveras Reservoir in southern Alameda County and San Andreas, Crystal Springs, and Pilarcitos Reservoirs on the Peninsula. In the event of an interruption to the water delivery system, these holding reservoirs can serve as an emergency water supply. The regional water system includes over 280 miles of pipelines, 60 miles of tunnels, five pumping stations, and two water treatment plants.

Redwood City has 12 water storage facilities that vary in size from 100,000 gallons to four million gallons (MG) with a combined storage capacity of 21.24 MG. Ten storage facilities are located in the higher elevations of Redwood City, and two are located in Redwood Shores. Ten pump stations are located throughout the distribution system, four of which have permanent stand−by generators. Two portable generators are available for emergency use.

In Redwood City, wastewater is collected and conveyed through a sewer pipeline system operated and maintained by the City to the South Bayside System Authority (SBSA), which treats and disposes of the City's sewage. The City's system is comprised of 192 miles of sewer mains and 31 sewer lift stations. Redwood City also has agreements with the County of San Mateo and the town of Woodside that permit these jurisdictions to convey wastewater through the City system to the SBSA treatment plant in Redwood Shores. SBSA is managed by a Joint Powers Authority (JPA) made up of Redwood City, San Carlos, Belmont and the West Bay Sanitary District. The JPA entities own the SBSA, with Redwood City's ownership at approximately 47 percent. SBSA is responsible for operation of four pump stations (one of which is in Redwood City), the force main, and the wastewater treatment plant. After treatment, the wastewater (called effluent) is discharged through an outfall into San Francisco Bay, as permitted by the San Francisco Regional Water Quality Control Board (RWQCB). The treatment plant's operating capacity is 29 million gallons per day of average dry weather flow.

Redwood City's sewer system is monitored to detect pipeline conditions. Condition assessment of the sewer pipeline is conducted using closed circuit television to determine the defects in the sewer pipelines. Typical problems can include pipeline cracks and improperly sealed joints that can cause groundwater infiltration during periods of wet weather. Excessive groundwater infiltration into sewer pipelines can overtax the capacity of the sewer system and treatment plant. Tree roots can intrude into pipelines causing blockage. Accumulations of fats, oils, and grease can coagulate and also block sewage flow. Redwood City has a Capital Improvement Program (CIP) developed for the wastewater system. Every year, the wastewater projects are reviewed, prioritized, and implemented to provide a safe and reliable system. Improvement projects ranging from rehabilitation of existing pump stations and replacement of aging sewer infrastructure are conducted yearly.

Redwood City has a roadway network of freeways, expressways, arterials, collectors, and local streets. Mass transit rail and bus facilities are also located within the City. Two freeways serve Redwood City: U.S. 101 and I-280, with U.S. 101 running through the City and I-280 southwest of our border. The California Department of Transportation (Caltrans) has responsibility for planning, operations, and maintenance along these freeways.

U.S. 101 is a major north-south regional route that passes through Redwood City on its course along the west coast of the United States. U.S. 101 is the primary San Francisco Peninsula commute route, bringing workers – and associated traffic congestion – into the City every day. Interchanges at Marsh Road (in Menlo Park), Woodside Road (State Route 84), and Whipple Avenue provide regional access to various parts of the City. Interchanges at Holly Street/Redwood Shores Parkway and Ralston Avenue/Marine Parkway provide access to the Redwood Shores area.

Along the west edge of the City, I-280 provides a more scenic commute route than U.S. 101, but does not provide immediate access to the local employment centers. Interchanges at Woodside Road, Farm Hill Boulevard, and Edgewood Road access Redwood City directly.

The San Carlos Airport, which separates Redwood Shores from the rest of Redwood City, is a general aviation airport. This airport, located in the city of San Carlos and maintained and operated by the San Mateo County Public Works Department, generates about 155,000 annual aircraft operations (i.e. landings and takeoffs), with about half of the operations serving local businesses through corporate or charter services. There is an airport noise abatement program in place to minimize aircraft noise impacts on surrounding communities.

Use of waterways for transportation dates back to the City's early years, when logging companies moved harvested redwoods to bayside docks for easy transport via water to distant markets. Today, the deep waters of the Port of Redwood City continue this important function, allowing bulk, neo-bulk, and liquid cargoes to be loaded onto and from large sea vessels. In 2008, about 1.5 million metric tons, consisting largely of recycled metal exports and building material imports, passed through the Port.

Healthcare

Redwood City has three distinct hospital/medical districts that draw patrons from the entire Peninsula, with the Kaiser Permanente hospital campus having a significant presence.

In 1973, as a direct result of the devastation caused by the 1971 Sylmar quake (65 deaths and a hospital collapse), the California Legislature passed the Alfred E. Alquist Hospital Seismic Safety Act. The act requires that acute care hospitals be designed and

constructed to withstand a major earthquake and remain operational immediately after the quake.

Further modifications of the Act occurred following the 1994 Northridge earthquake, with the passage of SB 1953 in 1994. SB 1953 requires that all hospitals use standards developed by the California Office of Statewide Health Planning and Development (OSHPD) to measure the ability of these buildings to withstand a major earthquake. In 2001, plans submitted by the hospital owners determined that 37% of California's hospitals are subject to collapse.

Both Kaiser and Sequoia hospitals are planning to construct new facilities to meet seismic safety standards. According to OSHPD, construction for both is scheduled to begin in April 2010, with both facilities being completed in Spring 2013.

Additional planning is needed at the city and county levels to identify and work with the ancillary health facilities in the region, including pharmacies, doctor and dentist offices, offices that sell hearing aids and eye glasses, dialysis centers, and emergency clinics. Currently there is NO state law requiring these facilities to be in structurally sound buildings, or that they have business continuity plans.

While hospitals are licensed by the State, ancillary facilities obtain their building permits and business licenses from cities and counties, ensuring that this effort remains local. There is a critical need for coordination of business recovery planning between City government, facility operators and owners.

Housing

Redwood City residents need to have safe and disaster-resistant housing that is architecturally diverse and serves a variety of household sizes and incomes. The City has many distinct residential Neighborhoods with unique characters, each influenced by predominant housing and architectural styles, street widths, trees, amenities, and densities. Redwood City has 2,966 single and multi unit residences within its incorporated area, with another 1,282 units (single and multi) within its Sphere of Influence.

Redwood City has strong, involved neighborhoods that reflect the diversity and character of the City. Some areas have their own organized neighborhood associations, affiliated with and recognized by the City, which meet periodically to discuss issues affecting their neighborhood. Other neighborhoods are not organized into associations, but also maintain a relationship with the City and work cooperatively to address problems they may be experiencing. Redwood City is committed to fostering strong, safe, and vibrant neighborhoods, and urges all residents to get involved

Economy

Since its beginnings, Redwood City has taken a leadership role in establishing new markets and new jobs for Peninsula residents: first as a lumber producer, then as a deep water port – a function that continues today – to a manufacturing and wholesale industrial economy, to the center of government for San Mateo County, and as the City entered the 21st century, as a premier location for knowledge and medical and biomedical industries in Silicon Valley. The local economy continues to evolve in response to changing regional and national economic trends.

As the County Seat, many local jobs consist of positions in government occupations. However, the private sector continues to account for a significant portion of local jobs. In 2006, approximately 47,000 private sector jobs were available in Redwood City, accounting for 15 percent of total jobs in San Mateo County.1 In Redwood City, the top private employment sectors include:

- Information Technology;
- Professional, Scientific, and Technical Services;
- Health Care;
- Retail Trade; and,
- Construction.

Combined, these five sectors (in 2006) accounted for over 31,000 local jobs, or 66 percent of all jobs in Redwood City.

Government

In California, there are two kinds of cities: charter cities and general law cities. Of the 477 cities in the state, 105, including Redwood City, are chartered meaning that the legal authority for the city's acts originates with a city charter, rather than from the laws of the State of California. Redwood City is located in the 11th Senate District, and in the 21st Assembly District. Federally, Redwood City is located in California's 12th and 14th congressional districts.

Redwood City operates under the ‘council-manager’ form of government, meaning that the Council appoints the city manager, who is then responsible for the administrative and staff-appointment duties. Contrary to the ‘strong mayor’ form of government (such as that in Oakland, San Francisco, and other larger cities), the day-to-day operations of the City are under the authority of the City Manager.

The City Council is the only body elected directly by the residents of Redwood City. As the legislative branch of the government, it makes final decisions on all major city matters. The Council adopts ordinances and resolutions necessary for efficient governmental operations, approves the budget, and acts as a board of appeals. It appoints the City Manager, City Attorney, and City Clerk and also the members of the City's boards, committees and commissions.

Schools and Education

Schools are critical to an ability to recover following an earthquake or other major disaster in Redwood City. While their principal mission prior to a disaster is education – whether they are a K-12 school or a college – their mission is more complex after a disaster hits. The City relies on schools to shelter those displaced from their homes, and as conduits for information to parents and others in the community, including post-disaster information.

In Redwood City, the Redwood City School District encompasses 18 schools and academies, including one child development center with over 8,600 students enrolled. Its sister district, Sequoia High School District, encompasses five high schools (including a continuation school), and has over 8,400 enrolled. The San Mateo Community College District operates Cañada College within the City limits, with enrollment of approximately 6000 students.

Environment

Disaster resistance should further environmental sustainability and reduce pollution in Redwood City. Chief among environmental concerns is the impact of human actions and choices on the atmosphere and climate. The air quality in Redwood City can be considered good. A BAAQMD air quality monitoring station located in Redwood City has recorded very low ozone levels, and particulate matter (PM) pollution levels that are considered average relative to the rest of the Bay Area. Local pockets of high and low PM levels occur throughout the City, depending on an area's proximity to PM sources like U.S. 101 or the Port. Measurements at Redwood City's testing station from 1998 to 2008 showed no noticeable time trend of increasing or decreasing ozone or PM levels.

Transportation sources account for the highest percentage of greenhouse gas emissions in most urban areas. Although the city has no ability to address vehicle emission directly from people driving their cars as they traverse the local highways, the city 2009 General Plan Update sets forth focused strategies to increase bicycle, pedestrian, and transit use; creates additional housing opportunities so more people can live closer to the many jobs available in the community; and facilitates the location of commercial goods and services within easy walking distance to neighborhoods, all in an effort to reduce environmental hazards resulting from greenhouse gas emissions.

In 2008, the Redwood City Cool Cities Team used the California Climate Action Network Best Practices Framework to survey actions the City has already taken and identify where more may be accomplished. This exercise identified areas of focus for the upcoming Climate Action Plan. Based on the 2008 survey, the City has taken many actions, including but not limited to:

Energy Efficiency and Conservation

- Installing equipment to reduce energy use including state-of-the-art light fixtures and pool pumps;
- Purchasing only Energy Star appliances; and,

- Participating in the NORESCO Energy retrofit project.

Water and Wastewater Systems

- Installing and/or replacing low flow equipment, landscape irrigation automated metering equipment;
- Managing water irrigation practices; and,
- Providing residential water audits and residential water conservation kits.

Land Use

The City's Land Use Plan within the City's General Plan guides the development, maintenance, and improvement of land and properties. It allows the City to preserve qualities that define itself, and develop new paths toward a sustainable future. Redwood City actively works towards creating a community that has a balanced mix of uses, and fosters economic, environmental, and social sustainability. The City continues to lead Peninsula cities in testing new ideas that support emerging business practices and lifestyle trends and needs, from high−density housing to flexible business space.

New approaches to land use planning and development are driven by the connections between land use (and transportation choices due to the land use patterns) and global warming. Table O-1 illustrates the distribution of land uses throughout Redwood City and the Sphere of Influence (together referred to as the planning area).

Table 1-1 Redwood City Land Use

Land Use	City (Incorporated) Acres	Sphere of Influence (Unincorporated) Acres	Total Acres	Percent
Residential (single-unit and multi-	2,966	1,282	4,248	17.5%
Commercial	976	29	1,050	4.3%
Industrial	361	122	483	2.0%
Public and Quasi-Public	433	39	472	1.9%
Open Space, Water, & Recreation	14,634	51	14,685	60.4%
Salt Harvesting	1,466	-	1,466	6.0%
Vacant	65	4	69	0.3%
Other (Streets, Rail lines)	1,487	395	1,882	7.7%
Total	22,388	1,922	24,355	100%

Source: San Mateo County Assessor 2008, Redwood City 2008.

SECTION 2 – PLANNING PROCESS

Overview of Planning Process

The development of the City of Redwood City LHMP originated from the City's Emergency Operations Plan and the Safety Element of the General Plan in August 2009. During the initial stages of the planning process, a Hazard Mitigation Team was created to provide input and guidance into the City of Redwood City LHMP. Once the Hazard Mitigation Team was formed, the following five-step planning process took place during the 5-month period from September 2009 to January 2010.

1. Organize resources: The Hazard Mitigation Team identified resources, including City staff, agencies, and local community members that could provide technical expertise and historical information needed in the development of the LHMP.

2. Assess risks: The Hazard Mitigation Team identified the hazards specific to the City, and developed the risk assessment for the seven identified hazards. The Planning Team reviewed the risk assessment, including the vulnerability analysis, prior to and during the development of the mitigation strategy.

3. Assess capabilities: The Hazard Mitigation Team reviewed current administrative and technical, legal and regulatory, and fiscal capabilities to determine whether existing provisions and requirements adequately address relevant hazards.

4. Develop a mitigation strategy: After reviewing the risks posed by each hazard, the Hazard Mitigation Team developed a comprehensive range of potential mitigation goals, objectives, and actions. Subsequently, the Hazard Mitigation Team identified and prioritized the actions to be implemented.

5. Monitor progress: The Hazard Mitigation Team developed an implementation process to ensure the success of an ongoing program to minimize hazard impacts to the community.

Hazard Mitigation Team

Formation of the Hazard Mitigation Team

As previously noted, the planning process began in September 2009. The Disaster Advisory Committee, having the overall responsibility of ensuring the City's emergency preparedness, started the planning process. The Disaster Advisory Committee designated the Fire Department as the lead agency for the LHMP development. The Fire Department delegated the planning process to an ad hoc committee called the Hazard Mitigation Team. The Hazard Mitigation Team members, led by Battalion Chief Dave Pucci are listed in Table 2-1.

Table 2-1 City of Redwood City Hazard Mitigation Team

Name	Position
Dave Pucci	Battalion Chief, Fire Department/Overall Team Lead
John LaTorra	Community Development Department
Fereydoun Shehabi	Construction and Engineering Department
Stephen DeJong	City Geographical Information Systems (GIS) Lead
Peter Vorametsanti	Construction and Engineering Department
Michael Gibbons	Public Works Department
Steve Longoria, CCP, CHS-III, CPM	Consulting Team Sr. Lead/Aanko Technologies Inc.
Dharme Rathnayke, P.E.	Consulting Team Engineering Lead/Aanko Technologies Inc.
Dan Voreyer	Consulting Team Fire Hazard Lead/Aanko Technologies Inc.
Rick Cruz, PA	Consulting Team General Hazard Lead/Aanko Technologies Inc.
Rasitha Rathnayke	Consulting Team GIS Lead/Aanko Technologies Inc.

Hazard Mitigation Team Meetings

The Hazard Mitigation Team met over the 5-month planning period from September 2009 through January 2010. During the kick-off meeting in September, the team discussed the objectives of the DMA 2000, the hazard mitigation planning process, the public outreach process, and the steps involved in developing the LHMP and achieving the City's goals. The presentation included a review of GIS technology as a tool for identifying and mapping known hazards in the City. Also discussed was the need for the Planning Team to network with other people in the City, other agencies, and other professionals who might have specialized knowledge about hazards that may affect the City.

A hazard risk identification exercise was conducted to familiarize the Planning Team with the approach and concepts that would be used in the risk identification phase of the LHMP development. The exercise identified the specific hazards that the Planning Team wanted to address in the LHMP. During the preliminary meeting in September 2009, the Hazard Mitigation Team developed available hazard data through interviews, meetings, City and County records, and GIS. In addition, the Hazard Mitigation Team developed a risk assessment and the City's GIS department conducted a vulnerability analysis.

During the second meeting in October 2009, the Planning Team reviewed the initial analysis of the risk assessment, describing which assets were analyzed and how values were estimated. In addition, the Planning Team reviewed and revised draft mitigation

goals and actions. Then, the team members evaluated the potential mitigation actions and selected and prioritized recommended mitigation actions.

Shortly after the planning process began, the Hazard Mitigation Team invited participation from the general public as well as public and private agencies. Information about the General Plan's Safety Element, and therefore relevant sections of the LHMP and planning process, was broadcast on the City's website. In addition, information about the Safety Element, and subsequently the LHMP, was addressed during City Council meetings and Planning Commission Meetings, from October 2009 to January 2010. The City Departments, San Mateo County Administration, local civic associations and nonprofit organizations were invited to each of the above meetings.

By December 2009, the Hazard Mitigation Team utilized public meetings to solicit public input. In January 2010, the Hazard Mitigation Team reviewed the risk assessment and developed a mitigation strategy and maintenance plan to ensure that the LHMP remains current and meets the goals, objectives, and action items established in the LHMP.

In December 2009, the City issued a press release regarding the review of the Draft LHMP. The press release was posted on the City's web site and included a phone number and email address for comments during the drafting stage. In January 2010, a second press release was issued to again announce the availability of the Public Review Draft of the LHMP. The City posted a copy of the Public Review Draft on its Web site on January 11th ahead of the February 11th City Council meeting for formal adoption of the LHMP Draft. Additionally, the City provided an e-mail address as well as a physical mailing address to receive public comments. The draft stayed posted on the City web site as the City Council meeting was postponed. As of the date of this Draft LHMP submission to CalEMA and FEMA on March 2, 2010, the City Council Meeting for formal adoption of this plan was scheduled for March 8, 2010.

At each level, the planning team reviewed and analyzed each section of the plan, and appropriate sections of the plan were revised based on team and public input. A snapshot of the public involvement press releases is identified in Appendix 2.

Planning Documents

During the planning process, the Hazard Mitigation Team reviewed and incorporated information from existing plans, studies, reports, and technical reports into the LHMP. A synopsis of the sources follows.

- City of Redwood City General Plan: The Land Use Element provides information on existing land use and future development trends. The Safety Element provides information for the initial hazard identification process and development of the mitigation strategy
- City of Redwood City Emergency Plan: This plan outlines current mitigation activities and response procedures, which were used for the mitigation strategy

- City of Redwood City Municipal Code: These codes regulate development and land use and were used for the capability assessment and mitigation strategy;
- City of Redwood City Sewer System Master Plan: identifies development of sewer system upgrades;
- San Mateo County General Plan: The county's General Plan was used for the risk assessment because it contains information on hazard areas adjacent to the City limits;
- State of California Multi-Hazard Mitigation Plan: This plan, prepared by CalEMA, was used to ensure that the City's LHMP was consistent with the State's Plan;
- Local and State land use regulations: Government Ordinances, codes, and permit requirements intended to make the private use of land and natural resources conform to policy standards. Common regulations include building codes; curb-cut permit systems; historic preservation laws; housing codes; subdivision regulations; tree-cutting laws; and zoning;
- Flood ordinances: Flood ordinances offer the management and the operation of our community program of corrective and preventative measures for reducing flood damage. These measures take a variety of forms and include requirements for zoning, subdivision or building, and special-purpose floodplain ordinances;
- Past disaster declarations: These provide a historical context for dame and disaster losses; and
- Flood Insurance Rate Maps (FIRMs): These are the official map(s) of a community on which FEMA has delineated both the special flood hazard areas and the risk premium zones applicable to the community.

The following FEMA guides were also consulted for general information on the LHMP process:

- How-To Guide #1: Getting Started: Building Support For Mitigation Planning;
- How-To Guide #2: Understanding Your Risks – Identifying Hazards and Estimating Loss Potential;
- How-To Guide #3: Developing the Mitigation Plan: Identifying Mitigation Actions and Implementing Strategies; and,
- How-To Guide #4: Bringing the Plan to Life: Implementing the Hazard Mitigation Plan.

SECTION 3 – RISK ASSESSMENT

This section identifies and profiles the hazards that could affect the City of Redwood City, assesses the risk of such hazards, describes the City's vulnerability, and estimates potential losses from the hazards.

Overview of a Risk Assessment

A risk assessment requires the collection and analysis of hazard-related data to enable local communities to identify and prioritize appropriate mitigation actions that will reduce losses from potential hazards.

The risk assessment has five steps, as outlined below and described in detail throughout the remainder of Section 3.

Step 1: Identify and Screen Hazards

Hazard identification is the process of recognizing natural and human-caused events that threaten an area. Natural hazards result from unexpected or uncontrollable natural events of sufficient magnitude to cause damage. Even though a particular hazard may not have occurred in recent history in the study area, all hazards that may potentially affect the study area are considered. Those that are unlikely to occur, or for which the risk of damage is accepted as very low, are then eliminated from consideration.

Step 2: Profile Hazards

Hazard profiling is accomplished by describing hazards in terms of their history, magnitude, duration, frequency, location, and probability. Hazards are identified through collection of historical and anecdotal information, review of existing plans and studies, and preparation of hazard maps of the study area. Hazard maps are used to determine the geographic extent of the hazards and define the approximate boundaries of areas at risk.

Step 3: Identify Assets

Assets are defined as the population, buildings, and critical facilities and infrastructure that may be affected by hazard events. Asset information was obtained from participating communities, the U.S. Census Bureau, and FEMA's HAZUS-MH software. Asset information is organized and categorized for analysis using GIS.

Step 4: Assess Vulnerabilities

A vulnerability analysis predicts the extent of exposure that may result from a hazard event of a given intensity in a given area. The assessment provides quantitative data that may be used to identify and prioritize potential mitigation measures by allowing communities to focus attention on areas with the greatest risk of damage.

Step 5: Analyze Future Development Trends

The final stage of the risk assessment process provides a general overview of development and population growth that is forecasted to occur within the City. This information provides the groundwork for decisions about mitigation strategies in developing areas and locations in which these strategies should be applied.

Step 1 - Identify and Screen Hazards

The risk assessment process is the identification and screening of hazards, as shown in Table 3-1.

Utilizing historical data from the National Oceanic and Atmospheric Administration (NOAA) National Climatic Data Center (NCDC), CalEMA, and FEMA Region IX, the Team developed and confirmed a list of those natural hazards of significance within the planning area. Significance was measured in general terms, focusing on key criteria such as frequency and resulting damage, including, deaths/injuries and property and economic damages to a community.

Based on historical occurrences specific to Redwood City and the surrounding area, the Team developed a listing of known natural hazards to be addressed in this plan. These known natural hazards were identified through an extensive process that involved the following:

- Coordination with various federal, state, and local agencies;
- Review of past disaster declarations at the federal and state level specific to Redwood City;
- Analysis of hazard identification and risk assessment publications at the state and local level;
- Limited field reconnaissance; and,
- Internet research.

During the initial stages of the planning process in 2009, the Hazard Mitigation Team identified 13 possible hazards that could affect Redwood City. The Planning Team evaluated and screened the comprehensive list of potential hazards based on a range of factors, including prior knowledge or perception of the relative risk presented by each hazard, the ability to mitigate the hazard, and the known or expected availability of information on the hazard (See Table 3-1).

The Hazard Mitigation Team screened all 13 possible hazards and determined that four hazards pose the greatest threat to Redwood City: earthquakes, floods, landslides, and wildland fires indicated in **bold** text with the associated priority in numerical bold (i.e. **Earthquake#1**). Two of the remaining nine hazards were incorporated into the four identified hazards (Dam Inundation and Expansive Soils) to be further analyzed. The remaining seven hazards excluded through the screening process were considered to pose

a lower threat to life and property in Redwood City due to the low likelihood of occurrence or the low probability that life and property would be significantly affected. Should the risk from these hazards increase in the future, the Redwood City LHMP can be updated to incorporate vulnerability analyses for these hazards.

Table 3-1 Hazard Identification and Screening

Hazard	Profiled?	Explanation
Avalanche	No	City is not located in area prone to frequent or significant snowfall.
Dam Inundation	Yes	The City is adjacent to a Dam and it does have a series of levees in the Redwood Shores area- included in the Flood Hazard Analysis
Drought	No	The City has established policies for allocation of water, water supply, and residential watering that diminishes the effects of this hazard.
Earthquake#1	Yes	The City is located in a geologically complex and seismically active region.
Expansive Soils	Yes	The City is located in a geologically complex region- included in the Landslide Analysis.
Extreme Heat	No	While extreme temperatures are known to occur, prolonged heat waves are rare.
Floods#3	Yes	Parts of community are located near floodplains and drainage ways. Heavy rains can cause localized flooding in certain areas.
Hurricane	No	No significant historic events have occurred.
Landslide#4	Yes	City is vulnerable to slope instability, especially after prolonged rainfalls.
Tornado	No	No significant historic events have occurred.
Tsunami	No	The City is not within the San Mateo County Tsunami Planning Zone.
Volcano	No	Not located near any active Volcano
Wildfire#2	Yes	The City faces wildland fire hazards due mainly to its climate and to the vegetation and topology around and within the City.

The specific hazards selected by the Planning Team for profiling have been examined in a methodical manner based on the following factors:

- Overview;
- History; and,
- Location, Extent & Probability of Future Events.

Step 2 - Profile Hazards

The hazards profiled for the City of Redwood City are presented in this Section in alphabetical order. The order of presentation does not signify the level of priority-that priority is noted in Table 3-1 above. The risk of each hazard is noted immediately after each identified hazard.

Earthquake

Risk Probability – High
Risk Severity – High

Overview

An earthquake is a sudden motion or trembling caused by a release of strain accumulated within or along the edge of the earth's tectonic plates. The effects of an earthquake can be felt far beyond the site of its occurrence. Earthquakes usually occur without warning and, after just a few seconds, can cause massive damage and extensive casualties. The most common effect of earthquakes is ground motion, or the vibration or shaking of the ground during an earthquake. The severity of ground motion generally increases with the amount of energy released and decreases with distance from the fault or epicenter of the earthquake. Ground motion causes waves in the earth's interior, also known as seismic waves, and along the earth's surface, known as surface waves. Two kinds of seismic waves exist. P (primary) waves are longitudinal or compressional waves similar in character to sound waves that cause back-and-forth oscillation along the direction of travel (vertical motion). S (secondary) waves, also known as shear waves, are slower than P waves and cause structures to vibrate from side to side (horizontal motion).

Also two kinds of surface waves exist: Raleigh waves and Love waves. These waves travel more slowly and typically are significantly less damaging than seismic waves. In addition to ground motion, several secondary hazards can occur from earthquakes, such as surface faulting. Surface faulting is the differential movement of two sides of a fault at the earth's surface. Displacement along faults, both in terms of length and width, varies but can be significant (e.g., up to 20 feet), as can the length of the surface rupture (e.g., up to 200 miles). Surface faulting can cause severe damage to linear structures, including railways, highways, pipelines, and tunnels.

Redwood City is located in the seismically active San Francisco Bay Area. The main feature generating the seismic activity in the region is the tectonic plate boundary between the North American and Pacific plates. Locally, this boundary is referred to as the San Andreas Fault Zone (SAFZ), which includes the San Andreas Fault and numerous other active faults.

The SAFZ includes active faults found by the California Geological Survey under the Alquist-Priolo Earthquake Fault Zoning Act (APEFZA) to be "active" (i.e., to have evidence of fault rupture in the past 11,000 years) (See Figure 3-1). Some of the major regional active faults within the SAFZ include the San Andreas, Hayward, Rodgers

Creek, Calaveras, San Gregorio-Seal Cove, Maacama, West Napa, Green Valley, Concord, Greenville, and Calaveras faults. The closest active fault to the City is the San Andreas Fault, located about 2,000 feet southwest of the western City boundary. The inactive Pilarcitos Fault runs almost parallel to the San Andreas Fault about two miles west of the City. The San Gregorio-Seal Cove, an active fault, is located about 9.5 miles west of the western City boundary. Smaller splay and thrust faults traverse through the City, and could have sympathetic movement coincident with a large earthquake on the Peninsula segment of the San Andreas fault.

In a fact sheet published in 2003, the U.S. Geological Survey estimated that there was a 62 percent probability that between 2003 and 2032, a 6.7 or greater magnitude earthquake will occur in the San Francisco Bay Region. The probability of a 6.7 magnitude or greater earthquake occurring along individual faults was estimated to be 21 percent along the San Andreas Fault, ten percent along the San Gregorio Fault, 27 percent along the Hayward-Rodgers Creek Fault, and 11 percent along the Calaveras Fault.

Seismic and Geologic Hazards

Surface Rupture

Surface rupture occurs when the ground surface is broken due to fault movement during an earthquake. The location of surface rupture generally can be assumed to be along an active major fault trace. The active San Andreas Fault is oriented roughly parallel to the western City boundary, with a local splay, known as the Cañada Fault, just west of the City. Areas within the Alquist-Priolo Earthquake Fault Zone require special studies to evaluate the potential for surface rupture to ensure that no structures intended for human occupancy are constructed across an active fault.

Multiple potentially-active Quaternary faults cross the City jurisdiction. These faults have evidence of activity between 11,000 years and 1.6 million years ago. The faults are not classified under the APEFZA to be active faults. The current version of the Alquist-Priolo mapping indicates that an APEFZA zone does not cross the City boundary; therefore, potential for fault rupture within the City jurisdiction is considered relatively low; however, ongoing studies by USGS and others are indicating that splay faults within 1 to 3 miles easterly of the San Andreas fault cannot be ruled out as having coincident sympathetic ground movements, so surface fault rupture within the city boundary cannot be entirely ruled out. Surface rupture can be very damaging to buried water and wastewater utilities owned by the city, as well as other buried utilities (PG&E and others) as well as to above ground structures.

Ground Shaking

Ground shaking is a general term referring to all aspects of motion of the earth's surface resulting from an earthquake, and is normally the major cause of damage in seismic events. The extent of ground shaking is controlled by the magnitude and intensity of the earthquake, distance from the epicenter, and local geologic conditions. Magnitude is a measure of the energy released by an earthquake; it is assessed by seismographs. Intensity is a subjective measure of the perceptible effects of seismic energy at a given

point and varies with distance from the epicenter and local geologic conditions. Intensity can also be quantitatively measured using accelerometers (strong motion seismographs) that record ground acceleration at a specific location, a measure of force applied to a structure under seismic shaking. Acceleration is measured as a fraction or percentage of the acceleration under gravity (g).

The San Andreas Fault is considered capable of generating a magnitude 7.9 earthquake, similar to the 1906 San Francisco earthquake. A 7.2 magnitude event on the Peninsula portion of the San Andreas Fault or a 7.9 event on the entire San Andreas Fault could be capable of generating violent to very strong seismic shaking in the City.

To the east, the Hayward fault could produce a 6.5 magnitude event that could result in moderate to strong seismic shaking in the City. Estimates of the peak ground acceleration have been made for the City based on probabilistic models that account for multiple seismic sources. Under these models, consideration of the probability of expected seismic events is incorporated into the calculated prediction of the level of ground shaking at a particular location. The expected peak horizontal acceleration (with a ten percent chance of being exceeded in the next 50 years) generated by any of the seismic sources potentially affecting the City is estimated by the California Geological Survey at 60% to 80% of the acceleration of gravity (g), with greater acceleration closer to the San Andreas fault. This level of ground shaking is a potentially significant hazard.

Liquefaction and Lateral Spreading

Earthquake-related ground failure due to liquefaction is another secondary hazard. Liquefaction is the temporary transformation of loose, saturated granular sediments from a solid state to a liquefied state as a result of seismic ground shaking. Liquefaction occurs when seismic waves pass through saturated granular soil, distorting its granular structure, and causing some of the empty spaces between granules to collapse. In the process, the soil undergoes temporary loss of strength, which commonly causes ground displacement or ground failure to occur. Since saturated soils are a necessary condition for liquefaction, soil layers in areas where the groundwater table is near the surface have higher liquefaction potential than those in which the water table is located at greater depths. Porewater pressure may also increase sufficiently to cause the soil to behave like a fluid for a brief period and cause deformations. Liquefaction causes lateral spreads (horizontal movements of commonly 10 to 15 feet, but up to 100 feet), flow failures (massive flows of soil, typically hundreds of feet, but up to 12 miles), and loss of bearing strength (soil deformations causing structures to settle or tip). Liquefaction can cause severe damage to property and complete destruction of buried utilities.

The lowland areas of Redwood City have a high potential for liquefaction. The kinds of soils typical of Redwood City include alluvial fan deposits, which are fine-grained soils with a clay consistency. In combination with the high groundwater table in the Redwood City area, such soils are highly susceptible to liquefaction, particularly during periods of prolonged rainfall. Regional liquefaction hazard mapping indicates that a 7.2 magnitude event on the Peninsula portion of the nearby active San Andreas Fault or a 7.9 event on

the entire San Andreas Fault or a moderately large event on the Hayward fault could result in moderate to high liquefaction risk in the lowland portions of Redwood City.

Portions of Redwood Shores and the Port of Redwood City may be exposed to liquefaction-induced ground settlement, and in some locations, lateral spreads. In such am event, there will be widespread damage to buried utilities; port facilities, and in some cases, to above ground structures.

High to very high liquefaction susceptibility was mapped in 2007 in the tidal flat areas of Redwood City, where a sand boil, formed by liquefaction during the 1989 Loma Prieta earthquake, was reported in Corkscrew Slough. Recent mapping shows moderate to very high liquefaction susceptibility in the tidal flat area based on soil type.

Figure 3-1 Active Fault Zones

The Seismic Hazards Mapping Act (SHMA) of 1997 established zones of required investigation and required site-specific geotechnical investigations within these zones to identify the seismic hazard and formulate mitigation measures prior to permitting developments designed for human occupancy. Seismic Hazard Zone Maps have not been developed for most of Redwood City, and are in progress for the Redwood Point and San Mateo quadrangles of maps prepared by the U.S. Geological Survey.

Lateral spreading is a form of horizontal displacement of soil toward an open channel or other "free" face, such as an excavation boundary. Lateral spreading can result from either the slump of low cohesion and unconsolidated material or more commonly by liquefaction of either the soil layer or a subsurface layer underlying soil material on a slope, resulting in gravitationally driven movement. Earthquake shaking leading to liquefaction of saturated soil can result in lateral spreading where the soil undergoes a temporary loss of strength. The City topography is flat to hilly and is traversed by creeks. Portions of the City are highly susceptible to liquefaction hazards (as shown in Figure 3-2), indicating that lateral movement to an open face is possible; therefore, the risk of lateral spreading is considered to be potentially significant.

History

The City of Redwood City and the surrounding region are subject to major earthquakes. As demonstrated by past earthquake events, such as the 1906 and 1989 earthquakes, a large earthquake will cause major damage on a regional basis, destroying or damaging thousands of buildings, disrupting transportation and utility systems, and causing thousands of injuries or fatalities.

Location, Extent, and Probability of Future Events

There are several fault zones which could potentially impact the city, most notably the San Andreas Fault runs north/south through the City of Redwood City. Regionally, there are many fault zones, including the Hayward to the east.

The City of Redwood City is going to be impacted by local and regional earthquakes of sufficient magnitude to cause death and destruction. The U.S. Geological Survey estimates a probability of two chances in three that a damaging earthquake will occur in the Bay Area within the next 30 years. Geologists are unable to predict which fault will fail, when it is going to fail, its magnitude, or shaking intensity. Nonetheless, they unequivocally affirm that there will be another earthquake, and that at some point in time it will adversely impact City of Redwood City.

For the City of Redwood City the primary concern is a combination of strong ground shaking combined with liquefaction. Localized landslides and sympathetic faulting cannot be ruled out. The underground water table is high in this area, and a significant portion of City of Redwood City residential and commercial units are located on soils subject to liquefaction. If liquefaction is widespread enough, there will almost certainly

be damage to buildings, roads, some types of buried telephone and electrical power lines, and most types of buried pipelines.

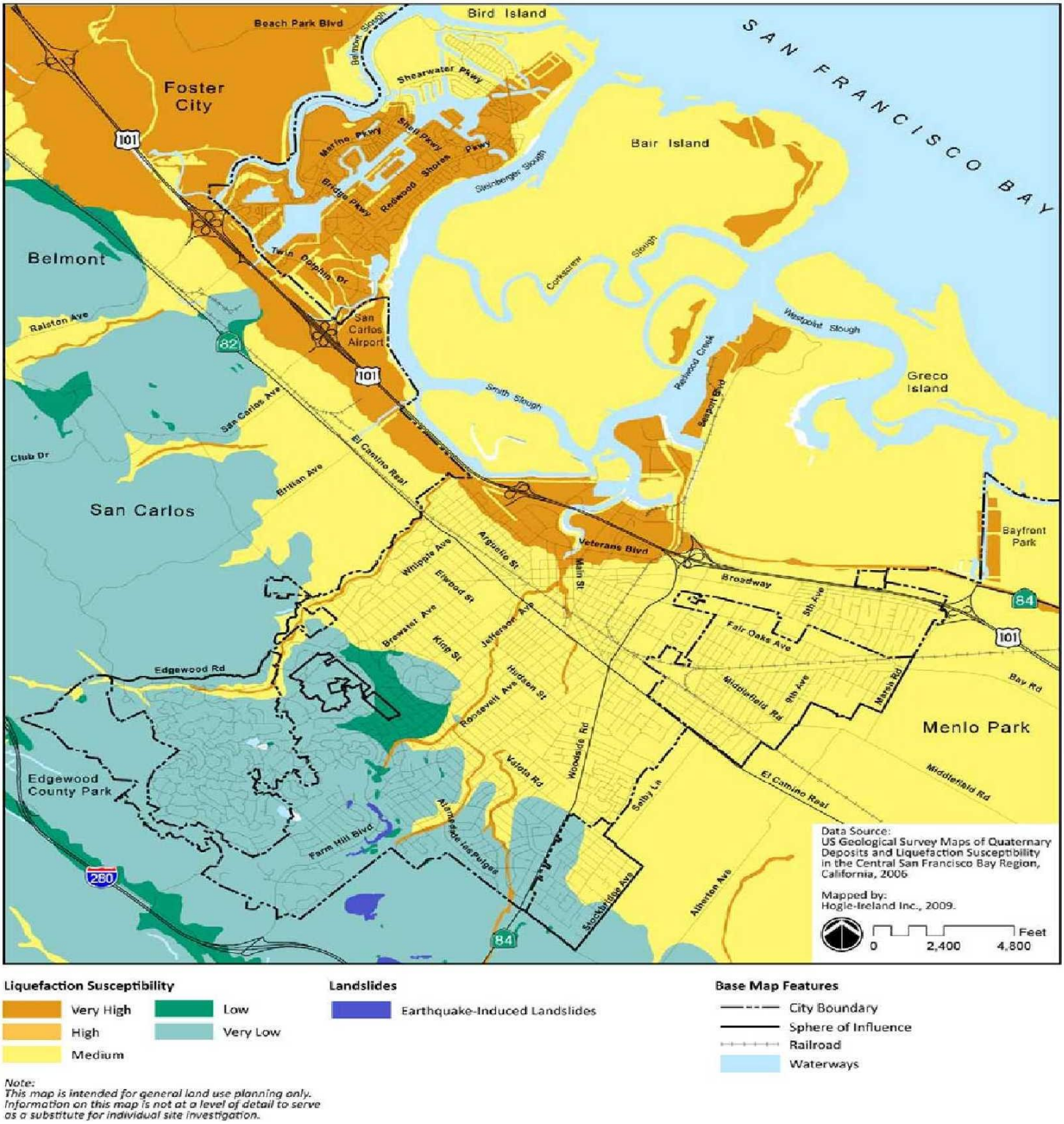
Sewer and water, natural gas and petroleum pipelines are the most common types of pipelines that may break as a result of liquefaction as almost none of these have even been designed to accommodate seismic loads; natural gas and petroleum pipelines may also break if they have not been design to the latest seismic standards. Such breaks can result in fires, flooding, health concerns and loss of water pressure at fire hydrants. Telephone communications and electrical power may be disrupted locally and regionally. The availability of potable water following an earthquake can be a serious problem.

Risk Assessment Conclusion

The greatest threat to this community from a natural hazard is that of a significant earthquake. The reasons for this are two-fold: First, the event itself can be catastrophic, with significant ground shaking expected to occur, and secondarily cascading effects (dam failure, liquefaction, landslides and structural hazards, flooding, fires, utility disruption,) can also significantly impact the safety of the public.

Based on the past history of damaging earthquakes and the fact that Redwood City is located within a seismically active region, the probability is rated HIGH. Given the properties at risk and the cascading effects the severity is rated as HIGH.

Figure 3-2 Liquefaction & Landslide Areas



Flood

Risk Probability – High
Risk Severity – Medium

Overview

Rainfall and inclement weather are primarily seasonal phenomena in the study area which boasts a mild Mediterranean climate. Generally the rainy season is from October through April. Typical rainfall amounts range from .03 (July) to 4.2 inches (January) over most of the study area,

Flooding is the accumulation of water where usually none occurs or excess water from a stream, river, lake, reservoir, or coastal body of water overflows onto adjacent floodplains. Floodplains are lowlands adjacent to water bodies that are subject to recurring floods. Floods are natural events that are considered hazards only when people and property are affected. Nationwide, floods result in more deaths than any other natural hazard. Physical damage from floods includes the following:

- Inundation of structures, causing water damage to structural elements and contents;
- Erosion or scouring of stream banks, roadway embankments, foundations, footings for bridge piers, and other features;
- Impact damage to structures, roads, bridges, culverts, and other features from high-velocity flow and from debris carried by floodwaters. Such debris may also accumulate on bridge piers and in culverts, increasing loads on these features or causing overtopping or backwater effects;
- Destruction of crops, erosion of topsoil, and deposition of debris and sediment on croplands; and,
- Release of sewage and hazardous or toxic materials as wastewater treatment plants are inundated, storage tanks are damaged, and pipelines are severed.

Floods also result in economic losses through closure of businesses and government facilities, disrupt communications, disrupt the provision of utilities such as water and sewer service, result in excessive expenditures for emergency response, and generally disrupt the normal function of a community.

Although flooding in other parts of the country can cause the loss of life in areas prone to dam failures or major river levee breaks, in Redwood City flooding has been historically associated with minor property damage and inconvenience. Inconvenience occurs when local roads or streets flood. In Redwood City, localized flooding can occur when substantial rainfall overwhelms the capacity of storm drains to convey runoff to creeks or the Bay (See Figure 3-3 and Figure 3-4).

The Federal Emergency Management Agency (FEMA) has been studying the system of levees that protect areas in Redwood City from the sea. Current levee heights were constructed to withstand a 100-year high tide. The two levees of most concern are: 1) the levee around The Preserve at Redwood Shores, and 2) the levee adjacent to San Carlos Airport, at Steinberger Slough. Redwood Shores is located on low-lying bayfront land surrounded by a levee system that protects this area from high tides. The crest of some levee reaches are at, or a few tenths of a foot lower than, the 100-year tide elevation. However, due to the short duration of that crest, flooding would be limited and shallow, provided that the levees themselves do not fail from the overtopping.

Figure 3-3 Flood Hazard Areas

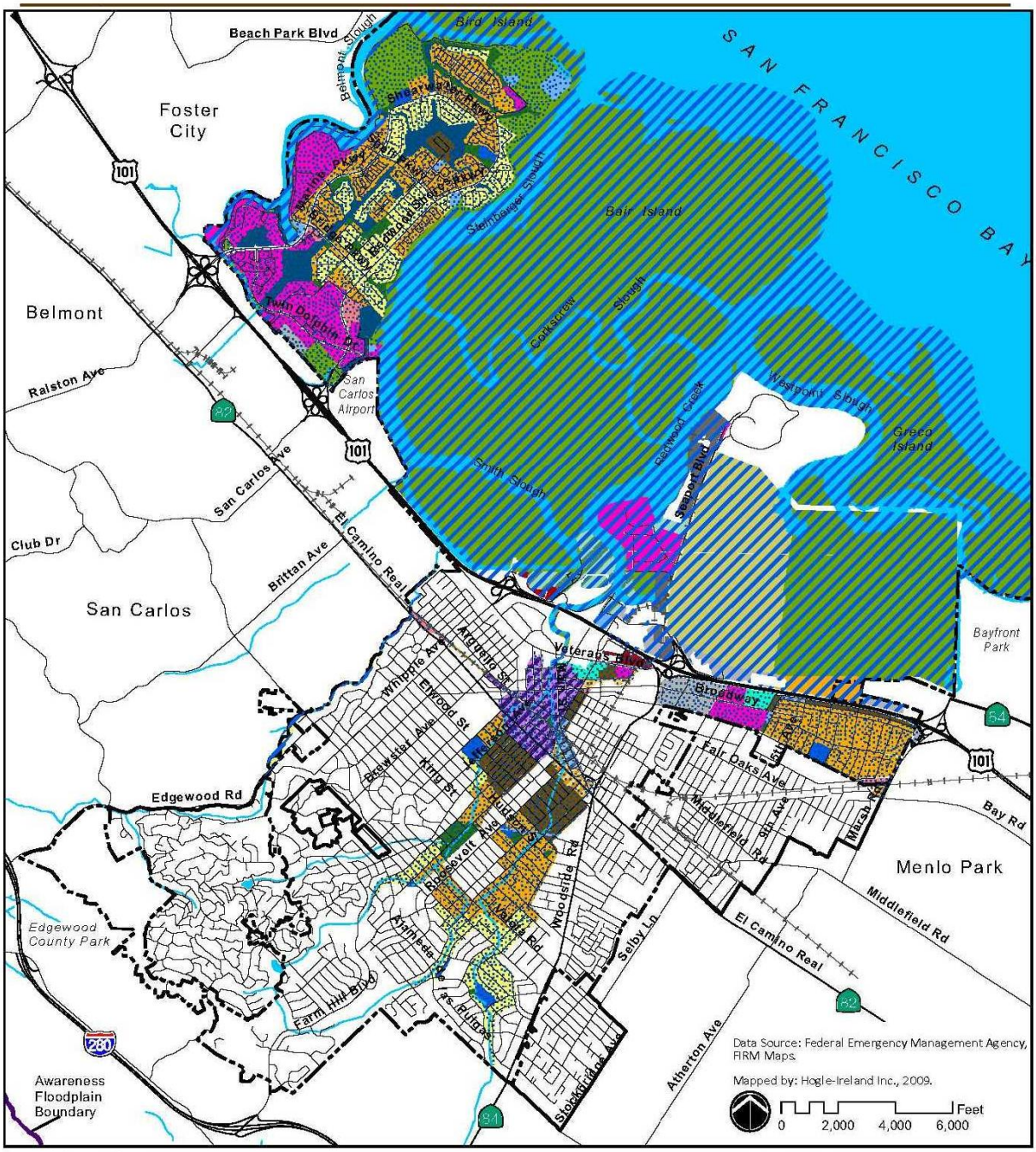
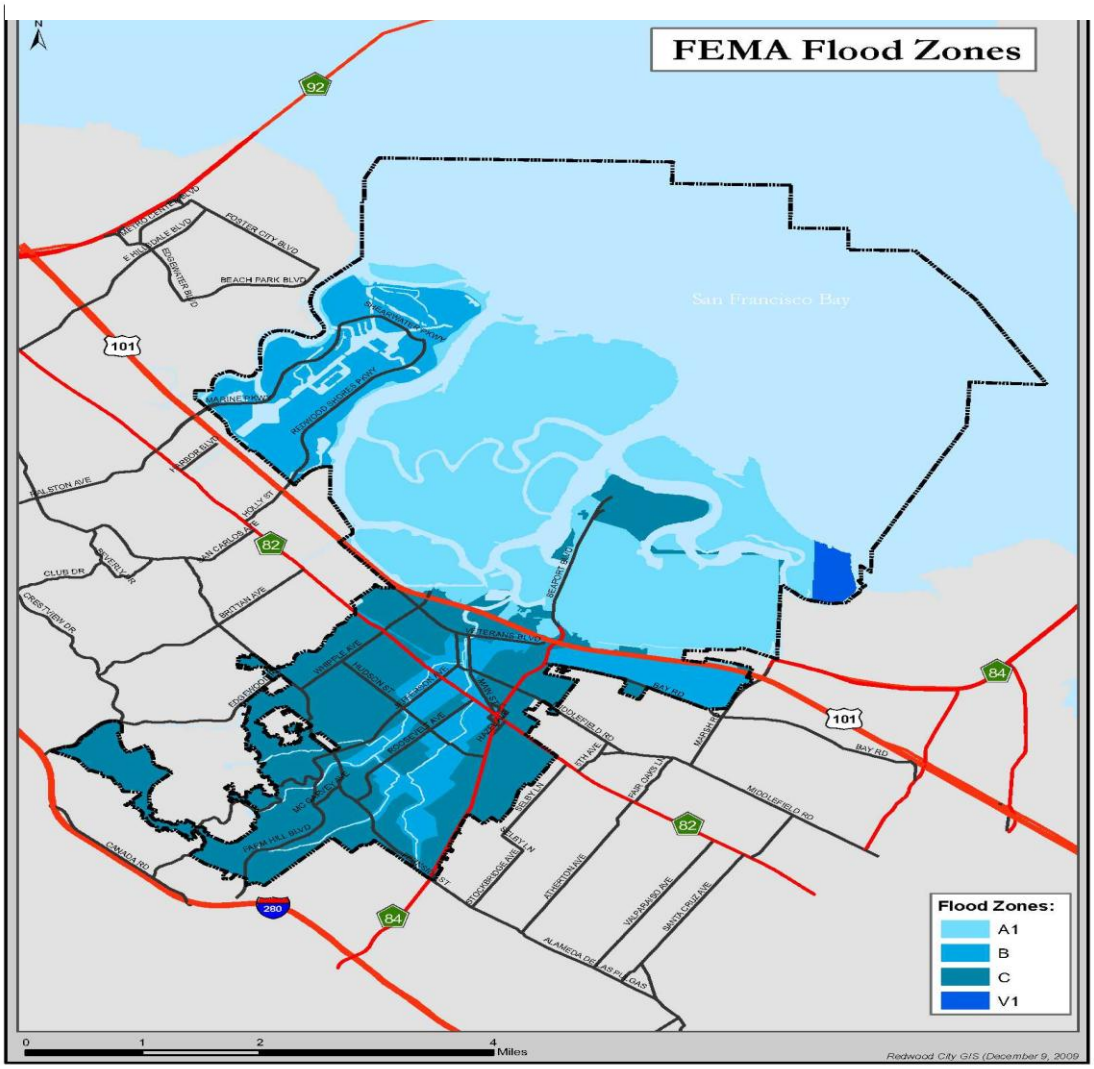


Figure 3-4 Redwood City FEMA Flood Zones



Definitions of FEMA Flood Zone Designations

Flood zones are geographic areas that the FEMA has defined according to varying levels of flood risk. These zones are depicted on a community's Flood Insurance Rate Map (FIRM) or Flood Hazard Boundary Map. Each zone reflects the severity or type of flooding area.

ZONE	DESCRIPTION
A1	A Zones are high risk areas with a 1% annual chance of flooding and a 26% chance of flooding over the life of a 30-year mortgage. Because detailed analyses are not performed for such areas; no depths or base flood elevations are shown within these zones.
B	Area of moderate flood hazard, usually the area between the limits of the 100-year and 500-year floods. B Zones are also used to designate base floodplains of lesser hazards, such as areas protected by levees from 100-year flood, or shallow flooding areas with average depths of less than one foot or drainage areas less than 1 square mile.
C	Area of minimal flood hazard, usually depicted on FIRMs as above the 500-year flood level. Zone C may have ponding and local drainage problems that don't warrant a detailed study or designation as base floodplain. Zone X is the area determined to be outside the 500-year flood and protected by levee from 100-year flood.
V1	High Risk coastal areas with a 1% or greater chance of flooding and an additional hazard associated with storm waves. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Base flood elevations derived from detailed analyses are shown at selected intervals within these zones.

Flood boundaries are currently being updated for Redwood City under the National Flood Insurance Act of 1968, as amended. In order to provide a national standard without regional discrimination, the 100-year flood has been adopted by the Federal Emergency Management Agency (FEMA) as the base flood for purposes of flood plain management measures (Zone A1). The 500-year flood is employed to indicate additional areas of flood risk in the community (Zone B). Areas of 100-year flood that are associated with coastal flood and wave action are identified as Zone V1. Prospective developments lying within one or another of these zones have specific flood damage avoidance requirements as part of the City's involvement in the National Flood Insurance Program (NFIP).

Localized flooding may occur outside of recognized drainage channels or delineated floodplains due to a combination of locally heavy precipitation, increased surface runoff, and inadequate facilities for drainage and stormwater conveyance. Such events can occur in flat areas and in urbanized areas with large impermeable surfaces. Local drainage may result in "nuisance flooding," in which streets or parking lots are temporarily closed; and minor property damage occurs. Because the effects are not widespread and damage is typically minimal, they are not studied in detail as part of this LHMP.

FEMA flood insurance rate maps (2009) show the areas of the City that are subject to 100-year and 500-year floods. Figure 3-3 shows these flood hazard areas as well as general plan land uses, to indicate locations of existing and planned development. The areas subject to 100-year floods are located nearest to the Bay, northeast of U.S. 101. The City has historically experienced mild flooding in the areas near Cordilleras Creek (descending from the Santa Cruz Mountains) and the Friendly Acres neighborhoods, southeast of Woodside Road, in areas identified in the 500-year flood plain. Redwood Shores is also located in the 500-year flood plain. It is anticipated that the current FEMA maps will be replaced by updated Digital Flood Insurance Rate Maps (DFIRMs) in spring 2010.

The California Department of Water Resources (DWR) has initiated the Awareness Floodplain Mapping project, with the goal of identifying all pertinent flood hazard areas in California by 2015 for areas that are not mapped under the FEMA National Flood Insurance Program and to provide the community and residents with an additional tool in understanding potential flood hazards that are currently not mapped as a regulated floodplain. The awareness maps identify the 100-year flood hazard areas using approximate assessment procedures. These floodplains are shown simply as flood prone areas without specific depths and other flood hazard data. The Awareness Floodplain Maps that have been created for the Redwood City area indicate that no Awareness Floodplain areas exist within the City as of 2009. However, Awareness Floodplain mapping efforts are ongoing.

Stormwater is rainwater and any other particles and substances that the rain carries along with it. In Redwood City, rain is collected (separate from the waste water system) and carried through a system of gutters, pipes, and other drainage structures. Runoff from higher elevations in the City and watershed flows downhill to the lower-lying San

Francisco Bay. Stormwater is conveyed into creeks, lined channels, storm drainage pipes, and lagoons, where gravity takes the stormwater towards the Bay. In low lying areas, the stormwater is collected in various stormwater pump stations that discharge into the Bay. Stormwater in Redwood City is not currently treated before it enters the Bay.

A watershed is an area of land that drains into a body of water. As rainwater runs downhill, it carries sediment and other materials into our streams, creeks, and eventually into the San Francisco Bay. There are 34 primary watersheds within San Mateo County. Portions of the San Francisquito, Redwood, Cordilleras, and Belmont watersheds are located within Redwood City.

Major segments of Redwood City's creeks are composed of concrete-lined channels, storm drainage pipes, and underground box culverts, which tend to increase stormwater runoff capacity and velocity and prevent stream bank erosion and flooding. These channels and pipelines, along with pump stations, are inspected and maintained by the Redwood City Public Works Services Department. The Public Works Services Department also works to ensure the streets, curbs, and gutters are clean to facilitate stormwater flow. In Redwood Shores, much of the flow drains into the 140 acres of lagoons, which store stormwater that is eventually discharged to San Francisco Bay.

For the most part, Redwood City is at sea level. It has over 100 miles of storm drain pipe, 75 tide gates, 82 open culverts, and over 10 miles of creeks, drainage ditches, and canals. Rainwater collects in catch basins, flows to the creeks, then downhill to one of 17 pump stations. These stations pump the storm water into the Bay to keep it from flooding low-lying areas of the City. The City's 75 tide gates keep high tides from pushing 'upstream' and overloading already-swollen creeks and basins, and during low tide the gates let creek water flow into the Bay.

History

Historically, the Friendly Acres/East Bayshore and the Centennial neighborhoods have experienced some degrees of flooding during storms, mostly due to overwhelming drainage infrastructure. The Friendly Acres/East Bayshore neighborhood near U.S. 101 and the northwestern portion of the Centennial Neighborhood adjacent to Cordilleras Creek are prone to flooding (See Figures 3-5 and 3-6). Flooding usually occurs when heavy rainfall coincides with high bay tides, thereby impeding runoff flow into the Bay and storm flows in excess of design capacity. Storm drains that are clogged with leaves and debris can also increase the chances of flooding during storms.

During the winter of 1998, unusually intense El Niño storms caused severe flooding of streets and homes in the Friendly Acres/East Bayshore neighborhood, prompting emergency evacuations of some area residents. In the Centennial neighborhood, Cordilleras Creek topped its banks causing flooding of residences in the lower creek reaches and extensive creek bank erosion throughout its length. In response, Redwood City developed a long-term strategic plan to address the problems of inadequate drainage and flooding in these areas

Figure 3-5 Friendly Acres Neighborhood

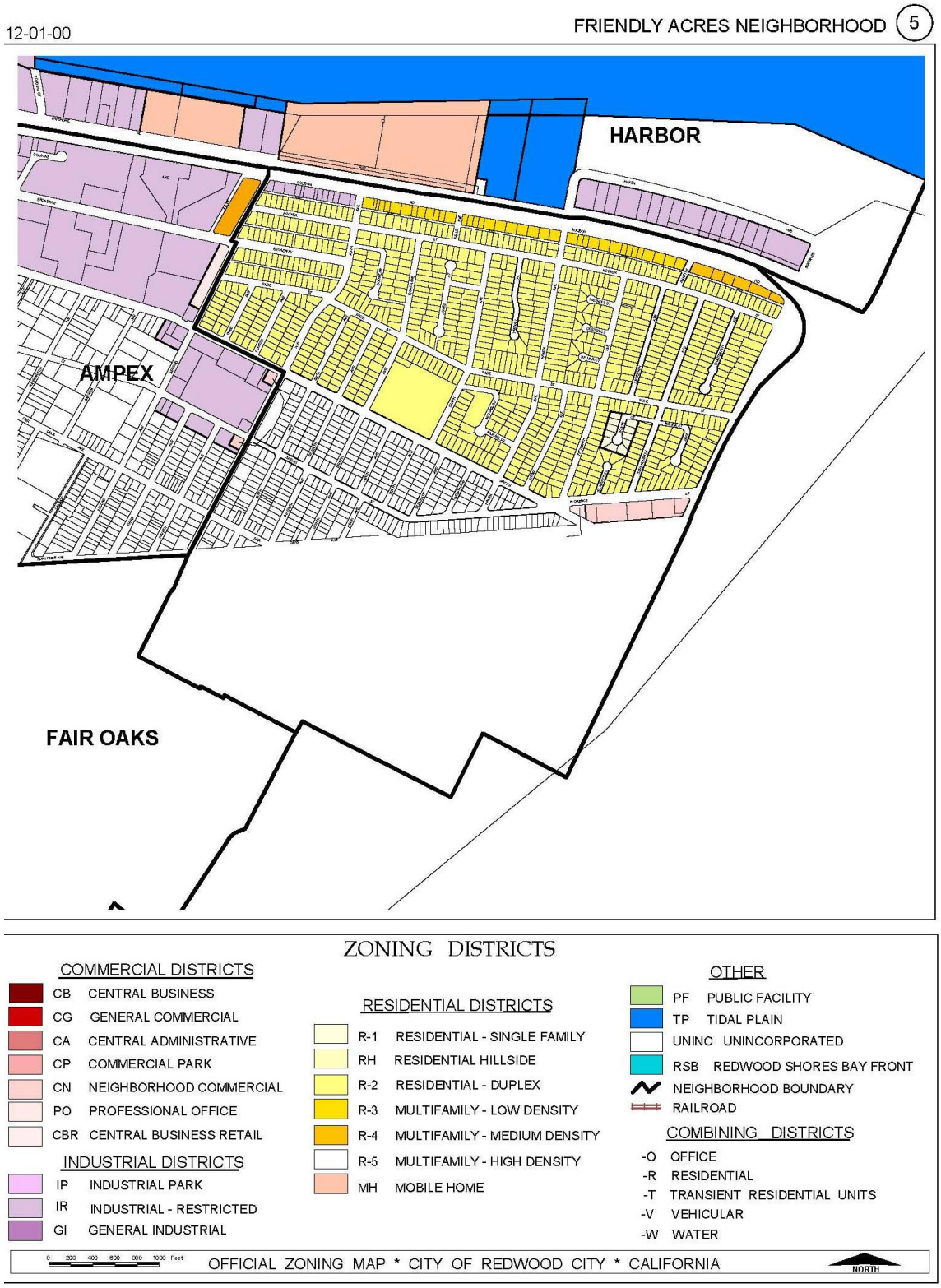
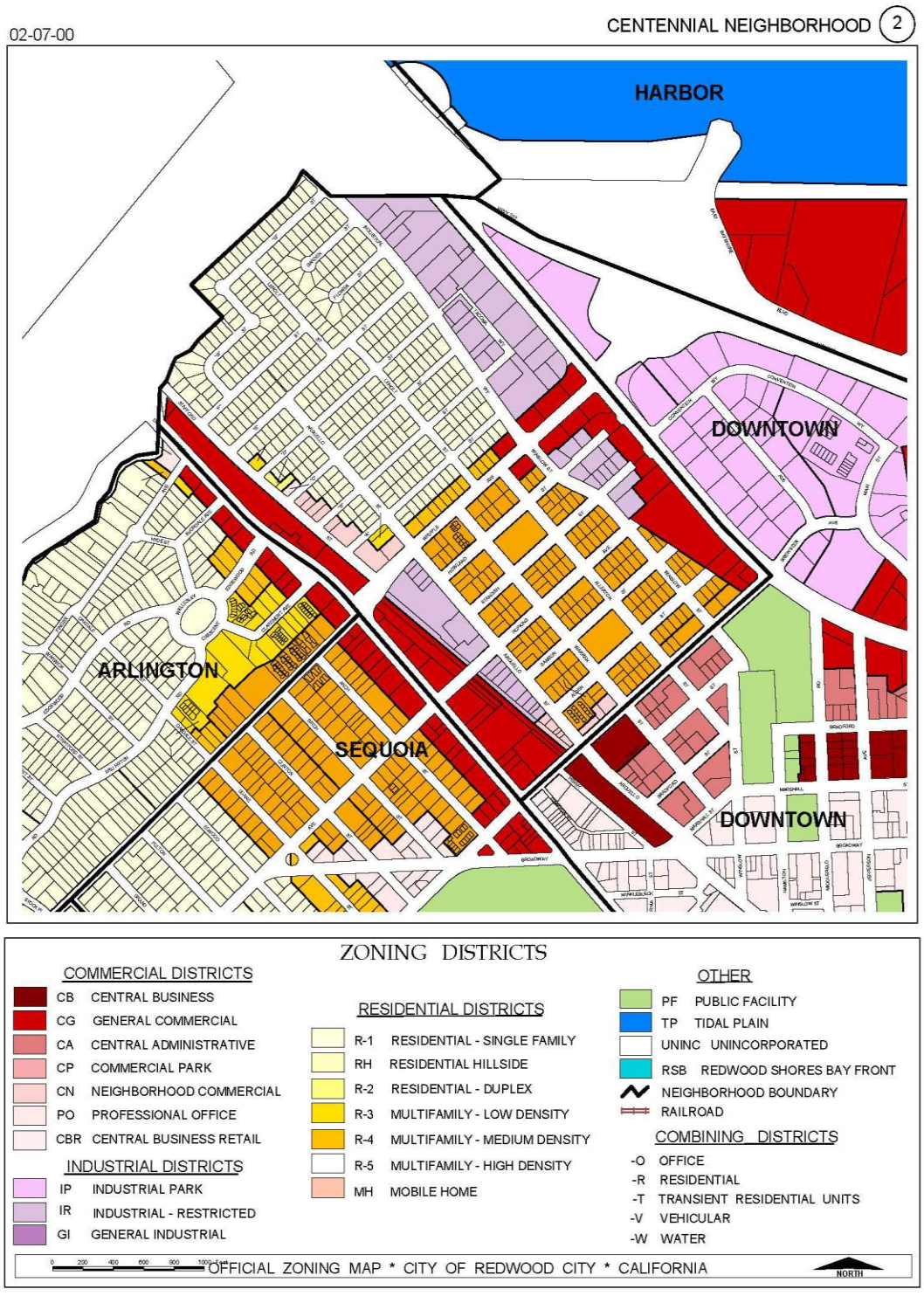


Figure 3-6 Centennial Neighborhood



In general, stormwater flows into the storm drainage system by gravity to various storm drain pump stations. The flooding in the Friendly Acres/East Bayshore neighborhood is due to increased runoff amounts throughout the watershed and an aging storm drainage system that does not have enough capacity to handle the increased runoff at this low-lying area of the City. The current storm drain system in this area includes a sub-drainage basin located beneath the Fifth Avenue/Hoover Street intersection where stormwater is temporarily stored. From there, the water flows through a pipeline beneath the 101 Freeway to the Fifth Avenue Pump Station draining into the Bayfront Canal. The Bayfront Canal discharges the collected stormwater into San Francisco Bay, but has limited storage capacity. The Bay Front Canal discharge is through a single controlled through tide gate structure located near Marsh Creek/Atherton Channel in Menlo Park.

Collected stormwater discharge occurs during low tides. Redwood City is addressing flooding conditions in the Friendly Acres/Fifth Avenue neighborhood. The City is increasing the capacity of stormwater transmission and distribution pipes in the Friendly Acres neighborhood. In addition, the Fifth Avenue Pump Station will be upgraded to increase capacity. Future plans include adding storm drainage storage from proposed future development. These future improvements are anticipated to be constructed over a period of several years. When these improvements are complete, they will provide a minimum 30-year storm level of flood protection for the Friendly Acres/Fifth Avenue neighborhood.

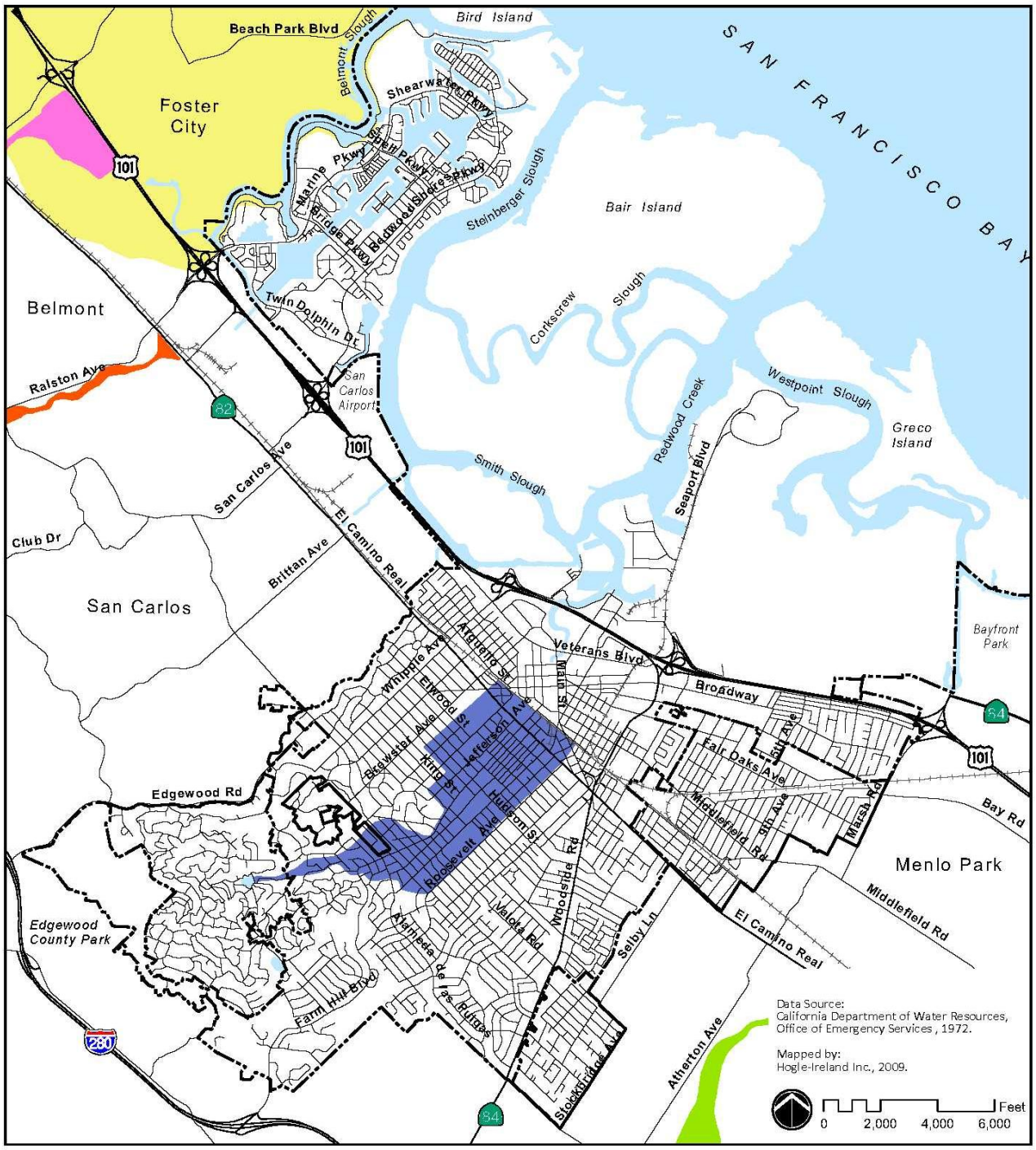
In the Centennial neighborhood, flood-prone areas are adjacent to Cordilleras Creek. A practical approach to alleviating flooding in this area is to educate creekside property owners in low-cost, ecologically enhancing methods to maintain and improve creek bank stability and prevent bank erosion and obstruction of the floodway. These efforts help reduce sedimentation that can block creek flow and obstruct culverts and contribute to flooding. Redwood City has also established setback limits from the center lines of creeks and tops of creek banks where new building is discouraged. Much of the watershed areas where stormwater runoff originates are located in jurisdictions outside of Redwood City.

Flooding due to Dam Inundation

Dams or reservoirs may fail for seismic or geologic reasons, which could potentially lead to damage of infrastructure and property located immediately downstream from these dams and reservoirs. Inundation areas, as provided by the California Emergency Management Agency, show the extent of damage to life and property that would occur, given a complete and sudden dam failure at full capacity (Figure 3-7).

The largest inundation area affecting the City is the potential inundation area from a sudden failure of the Lower Emerald Lake Dam. The Lower Emerald Lake Dam is 2.25 miles west/southwest of downtown Redwood City. It has an elevation of 259 feet. If the Lower Emerald Lake dam failed catastrophically, water would travel downwards along natural drainage courses in a northeast direction, eventually ending at El Camino Real. It is likely that the most extensive damage would be expected for structures and facilities located in close proximity below the lake. Farther from the dam, flood damage would be expected as water would spread across the City.

Figure 3-7 Dam Inundation Areas



Location, Extent, and Probability of Future Events

Large areas of the City lie within 100 or 500 year flood plains. Floods are described in terms of their extent (including the horizontal area affected and the vertical depth of floodwaters) and the related probability of occurrence. Flood studies often use historical records, such as stream flow gages, to determine the probability of occurrence for floods of different magnitudes. The probability of occurrence is expressed in percentages as the chance of a flood of a specific extent occurring in any given year. Factors contributing to the frequency and severity of flooding include the following:

- Rainfall intensity and duration;
- Antecedent moisture conditions;
- Watershed conditions, including steepness of terrain, soil types, amount and type of vegetation, and density of development;
- The existence of attenuating features in the watershed, including natural features such as swamps and lakes and human-built features such as dams and levees;
- The existence of flood control features, such as levees and flood control channels; and,
- Velocity of flow.

These factors are evaluated using a hydrologic analysis to determine the probability that a discharge of a certain size will occur; and a hydraulic analysis to determine the characteristics and depth of the flood that results from that discharge.

The magnitude of flood used as the standard for floodplain management in the United States is a flood having a probability of occurrence of 1 percent in any given year. This flood is also known as the 100-year flood or base flood. The most readily available source of information regarding the 100-year flood is the system of Flood Insurance Rate Maps (FIRMs) prepared by FEMA.

These maps are used to support the National Flood Insurance Program (NFIP). The FIRMs show 100-year floodplain boundaries for identified flood hazards. These areas are also referred to as Special Flood Hazard Areas (SFHAs) and are the basis for flood insurance and floodplain management requirements. The FIRMs also show floodplain boundaries for the 500-year flood, which is the flood having a 0.2 percent chance of occurrence in any given year. FEMA has prepared a FIRM for the City of Redwood City.

There is a potential for flooding at the Redwood Shores area of the City. There, a new levee improvement project is underway (notice to proceed in December 2009) to raise the levees from 10 -12 feet to 12 1/2 feet to meet FEMA FIRM requirements.

Risk Assessment Conclusion

While it is impossible to predict future long range weather patterns, it is certain that the location of the City, near the Pacific Ocean to the west and adjacent to the San Francisco Bay to the east, will continue to have a significant exposure to major winter storms and

flooding. Therefore, the probability is HIGH and the severity, based on the fact that only limited areas of the City are exposed, is MEDIUM.

Landslide

Risk Probability – Medium
Risk Severity – Medium

Overview

The northeastern portion of the City is located in existing and former tidal marshes at elevations near sea level. The central portion of City, located southwest of Interstate Highway 101 and including El Camino Real, is a gently sloping plain draining northeast to the tidal marsh, with elevations up to about 20 feet National Geodetic Vertical Datum of 1929 (NGVD). The southwestern portion of the City forms the eastern foothills of the Santa Cruz Mountains, and has elevations up to about 600 feet sloping northeast NGVD. Most of this portion of the City is developed as residences and parks.

The City is located on the San Francisco Peninsula south of the City of San Francisco. The Peninsula is traversed by three large faults of the San Andreas Fault System: the San Andreas, the Pilarcitos, and the San Gregorio Faults. These faults have divided the Peninsula into geologic units. The City is located east of the San Andreas Fault in the San Francisco Bay Block or geologic unit. This Block is characterized by Franciscan basement rocks and rocks sheared by fault movement.

Geologic units underlying the City vary with distance from the San Andreas Fault. The southwestern portion of the City is located adjacent to the San Andreas Fault Zone, and includes serpentinite, greenstone, and sheared rock including greywacke, siltstone, and shale of Jurassic and Cretaceous age. The central portion of the City is underlain by coarse grained older Quaternary alluvial fan and stream terrace deposits, and younger Quaternary finer-grained alluvial fan deposits and basin deposits of silt and clay closer to the San Francisco Bay. The eastern portion of the City, beneath and east of Interstate 101, is underlain by Holocene Bay Mud. Bay Mud consists of organic fine clay and silt. Some of the former tidal flats are covered with man-made fill.

Soil is generally defined as the unconsolidated mixture of mineral grains and organic material that mantles the land surface. Three basic categories of soils are present in Redwood City. Soils in the current and former tidal flat areas are classified as Urban Land Orthents, and include the Novato and Reyes Series soils. These soils are nearly level, poorly drained, clay and silty clay on reclaimed tidal flats with high shrink-swell potential. Soils in the central portion of Redwood City including the downtown area are also classified as Urban Land Orthents on nearly level to gently sloping land. These soils can be poorly drained to well-drained, and are present on alluvial fans, flood plains, and stream terraces. Soils in the upland areas of Redwood City are Urban Land Orthents including the Los Gatos and Fagan Series soils. These soils are present on gently rolling to very steep terrain, and are well-drained and underlain by sandstone.

Landslide is a general term for the dislodgment and fall of a mass of soil or rocks along a sloped surface or for the dislodged mass itself. The term is used for varying phenomena, including mudflows, mudslides, debris flows, rock falls, rock slides, debris avalanches, debris slides, and slump-earth flows. Landslides may result from a wide range of combinations of natural rock, soil, or artificial fill. The susceptibility of hillside and mountainous areas to landslides depends on variations in geology, topography, vegetation, and weather. Landslides may also occur due to indiscriminate development of sloping ground or the creation of cut-and-fill slopes in areas of unstable or inadequately stable geologic conditions.

Additionally, landslides often occur together with other natural hazards, thereby exacerbating conditions, as described below.

- Shaking due to earthquakes can trigger events ranging from rock falls and topples to deep seated slides and debris flows;
- Intense or prolonged precipitation that causes flooding can also saturate slopes and cause failures leading to landslides;
- Landslides into a reservoir can indirectly compromise dam safety, and a landslide can even affect the dam itself. Even without direct damage, such landslides can create long-lasting severe turbidity events, making it difficult or impossible to use the water in the reservoir as a raw water supply to water treatment plants, and;
- Wildfires can remove vegetation from hillsides, significantly increasing runoff and landslide potential.

Expansive Soils

Soil volume expansion and contraction can occur when expansive soils are subjected to a change in moisture resulting in wet soils (swelling) or dry soils (shrinking). During these conditions, the volume of the soil changes markedly. As a consequence of such volume changes, structural damage to building and infrastructure may occur if the potentially expansive soils were not considered in project design and during construction.

The Novato and Reyes Series soils in the lowland portions of Redwood City are predominately clays and silty clays with high shrink-swell potential. The Fagan Series soils in the upland areas also have a high percentage of clay and moderate to high shrink-swell potential. Clay and associated materials can result in weak, compressible, or expansive soils. These soils are classified as expansive soils.

History

Landslide events are common occurrences outside of the City limits, along the steep slopes and the coastal mountain areas of the county. The largest landslide events within the City have been associated with severe winter storms. Only small landslides along unstable slopes saturated during prolonged and/or intense rain events have occurred within the City.

Location, Extent, and Probability of Future Events

Properties in the southwest hills of Redwood City may be at risk of slope failure. Slope instability in the City generally increases with areas of steep terrain that consist of fractured soil or thin layers of clay that are susceptible to erosion and landslide. The likelihood of sliding increases during or after a period of heavy rain, when saturated soil fractures or weak spots give way. Therefore, while slides generally occur during the rainy season, after very wet winters, deep-seated landslides can continue to become active for many months, extending well into the summer.

Slope failure can occur as either rapid movement of large masses of soil ("landslide") or slow, continuous movement ("creep"). The primary factors influencing the stability of a slope are: 1) the nature of the underlying soil or bedrock; 2) the geometry of the slope (height and steepness); 3) rainfall; and 4) the presence of previous landslide deposits. Most of the hills in the southwest portion of Redwood City are mapped as "few or very few landslides". However, two small areas within the southwest hills of Redwood City near Stulsaft Park are identified as "mostly landslide," indicating the potential for slides and earthflows in the area. The lower elevations in the eastern and northeastern portion of Redwood City are mapped as "flatland" with no landslides.

Development or redevelopment of properties in lowland areas have a potential for settlement due to expansive soils. Areas in the former tidal flats have a potential for settlement due to unconsolidated fill and low strength native soils.

Risk Assessment Conclusion
Given the past history and the naturally occur conditions, the probability for this event reoccurring in certain portions of the City is rated as MEDIUM. The limited number of vulnerable structures, and the slow moving nature of the past occurrences, results in a MEDIUM severity rating.

Wildland Fires

Risk Probability – Medium
Risk Severity – High

Overview
A wildland fire is a type of fire that spreads through all types of vegetation. It often begins unnoticed, spreads quickly, and is usually signaled by dense smoke that may be visible from miles around. Wildland fires can be caused by human activities (such as arson or campfires) or by natural events such as lightning. Wildland fires often occur in forests or other areas with ample vegetation. In addition to wildland fires, wildfires can be classified as urban fires, interface or intermix fires, and prescribed burns.

The following three factors contribute significantly to wildland fire behavior and can be used to identify wildland fire hazard areas (See Figure 3-8):

Topography: As slope increases, the rate of wildland fire spread typically increases. Southfacing slopes are also subject to more solar radiation, making them drier and thereby intensifying wildland fire behavior. However, ridge tops may mark the end of wildland fire spread, since fire spreads more slowly or may even be unable to spread downhill.

Fuel: The type and condition of vegetation plays a significant role in the occurrence and spread of wildland fires. Certain types of plants are more susceptible to burning or will burn with greater intensity. Dense or overgrown vegetation increases the amount of combustible material available to fuel the fire (referred to as the "fuel load"). The ratio of living to dead plant matter is also important. The risk of fire is increased significantly during periods of prolonged drought as the moisture content of both living and dead plant matter decreases. The fuel's continuity, both horizontally and vertically, is also an important factor. By breaking up or thinning fuel beds one can slow the rapid spread rates of wildfires. In addition the removal of certain fuels in the horizontal plane can prevent fires from "laddering" into the tops of trees where it may burn hotter and be more difficult to contain.

Weather: The most variable factor affecting wildland fire behavior is weather. Temperature, humidity, wind, and lightning can affect chances for ignition and spread of fire. Extreme weather, such as high temperatures and low humidity, can lead to extreme wildland fire activity. By contrast, cooling and higher humidity often signals reduced wildland fire occurrence and easier containment.

The frequency and severity of wildland fires is also dependent upon other hazards, such as lightning, drought, and infestations. If not promptly controlled, wildland fires may grow into an emergency or disaster. Even small fires can threaten lives and resources and destroy improved properties. In addition to affecting people, wildland fires may severely affect livestock and pets.

Such events may require emergency watering/feeding, evacuation, and shelter. The indirect effects of wildland fires can be catastrophic. In addition to stripping the land of vegetation and destroying forest resources, large, intense fires can harm the soil, waterways, and the land itself. Soil exposed to intense heat may lose its capability to absorb moisture and support life. Exposed soils erode quickly and enhance siltation of rivers and streams, thereby enhancing flood potential, harming aquatic life, and degrading water quality. Lands stripped of vegetation are also subject to increased debris flow hazards, as described above.

The brush-covered hills in southwest Redwood City pose potential wildland fire hazards to the residential neighborhoods there. Long and dry summers, combined with highly flammable vegetation, can increase the possibility of wildfires. Understanding the risks associated with development in and near fire-prone areas can help advance planning to reduce the risks associated with major wildland fires.

Due to the wildland fires that have plagued California, the California Department of Forestry and Fire Protection (CalFire) is required to review, map, and update Fire Hazard Severity Zones for State Responsibility Areas (SRA). These are areas outside of city limits where the State has responsibility for wildland fire protection. Cal Fire is also tasked with reviewing, mapping and updating Very High Fire Hazard Severity Zones for Local Responsibility Areas (LRA). These are areas where local government has responsibility for wildland fire protection. The City has adopted this map (Figure 3-8) for properties within its jurisdiction; approximately 1,200 properties lie within the Very High Fire Severity Zone in Redwood City.

New construction within this zone is required to comply with California Building Code Chapter 7A, including requirements for fire retardant or ignition resistant construction materials at roofs, eaves, vents, exterior walls, exterior windows and doors, decks, and areas below decks. California Government Code §51182 also requires buildings within these areas to provide defensible space. Defensible space must be maintained up to 100 feet (or the property line, whichever is less) from the building.

History

There have been no significant wildland fires (over 100 acres) within the jurisdictional limits of the City within the last ten years.

Location, Extent, and Probability of Future Events

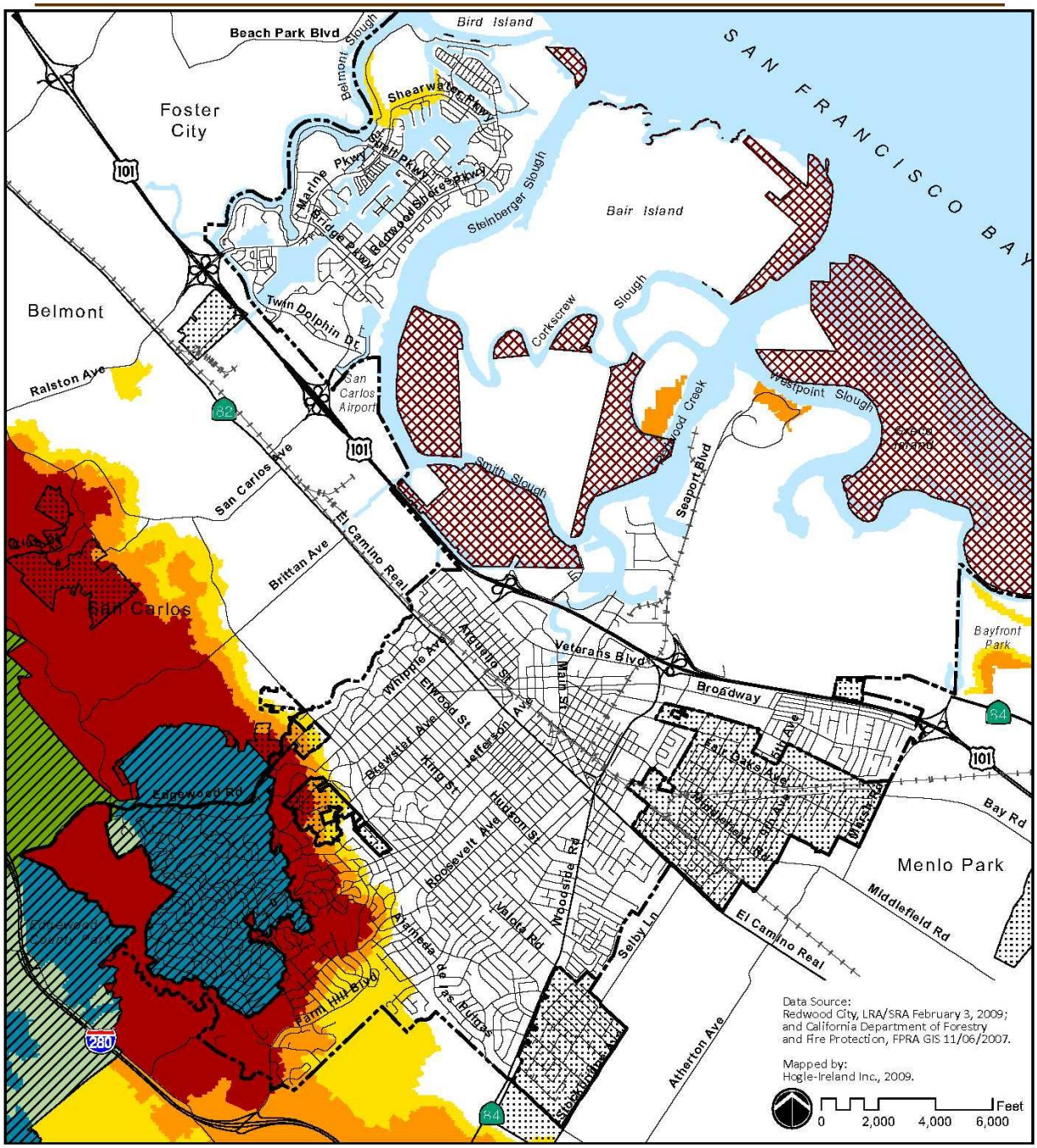
All hillside areas lie within high fire hazard zones. Figure 3-8 displays both the location and extent of wildland fire hazard areas for Redwood City. This map is based on general slope and vegetation type. The risk of wildland fires increases at the City limits as this area is part of a wildland/urban interface zone, where development meets rural areas of combustible vegetation.

Generally, fire susceptibility throughout California dramatically increases in the late summer and early autumn as vegetation dries out, decreasing plant moisture content and increasing the ratio of dead fuel to living fuel. Based on previous occurrences, it is not expected that a significant wildfire will occur within the incorporated City limits, however, as mentioned above, fires that spread from adjacent areas may still occur in the City. However, other various factors, including humidity, wind speed and direction, fuel load and fuel type, and topography, can contribute to the intensity and spread of wildland fires from neighboring unincorporated areas of San Mateo County.

Risk Assessment Conclusion

While in certain locations the fuels and the topography exist to allow an unchecked wildfire to become quite a threat, a strong wildland Urban Interface Fire threat prevention program in existence within the community aids in mitigation of the hazard, though other risks as noted above remain. Therefore, the probability is MEDIUM, and the severity is HIGH.

Figure 3-8 Fire Hazard Areas



Step 3 - Asset Identification

This section describes the third step in the risk assessment process, which is the identification of assets that may be affected by hazard events. Assets identified for the risk assessment include population, buildings, and critical facilities and infrastructure that may be affected by hazard events. The assets identified are discussed in detail below.

Population and Buildings
Population data, as shown in Table 3-2 was obtained from the 2000 U.S. Census. Data were collected at the census block level for the City. The City's total population for 2000 was 75,402. Building data was obtained from City GIS.

Estimated numbers of residential and nonresidential buildings and replacement values for those structures, as shown in Table 3-2, were obtained from the U.S. Census, the City, and HAZUS- MH by census block. A total of 18,046 residential and mixed use buildings were considered in this analysis, including single-family dwellings, mobile homes, multifamily dwellings, temporary lodgings, institutional dormitory facilities, and nursing homes. A total of 1316 nonresidential buildings were also analyzed, including industry, retail trade, wholesale trade, personal and repair services, professional and technical services, banks, medical offices, religious centers, entertainment and recreational facilities, theaters, and parking facilities.

Table 3-2 Population and Buildings

Population	**Residential/Mixed Use Buildings**		**Nonresidential Buildings**	
2000 Census	**Total Buildings**	**Value (Millions)**	**Total Buildings**	**Value (Millions)**
75,402	18,046	11,001	1,316	3,783

Source: U.S. Census 2000 population data. City GIS and FEMA HAZUS-MH.
Population count using census blocks within the city limits.
Value based on 2005 San Mateo County Assessor Data

Critical Facilities and Infrastructure

A critical facility is defined as a facility in either the public or private sector that provides essential products and services to the general public, such as preserving the quality of life in the City and fulfilling important public safety, emergency response, and disaster recovery functions. Similar to critical facilities, critical infrastructure includes infrastructure that is essential to preserving the quality of life and safety in the City. Critical facilities and infrastructure identified within the City are shown in Table 3-3.

Table 3-3 Critical Facilities and Infrastructure

City Hall	Community Activities Building
Police Department	Fair Oaks Community Center
Fire Station # 9	Fair Oaks Library
Fire Station #10	Veteran's Memorial Senior Center and Annex Building
Fire Station #11	Red Morton Community Center
Fire Station #12	Sequoia Hospital
Fire Station #20	Kaiser Hospital
Water System	Storm Drain and Sewer Systems
Port of Redwood City Facilities (Wharves & Building)	

Note:

Water system critical infrastructure owned by the City of Redwood City includes:

- 12 water storage tanks;
- 10 pump stations; and,
- nearly 300 miles of below ground water pipelines.

Storm drain system critical infrastructure owned by the City of Redwood City includes:

- 22 Pump Stations;
- 2,685 storm drain catch basins;
- 170 siphon storm drain catch basins;
- Over 100 miles of storm drain pipe;
- Over 10 miles of creeks; and,
- 150 acres of storm retention basin in the Redwood Shores area.

Sewer system critical infrastructure owned by the City of Redwood City includes:

- 280 miles of sewer main line; and
- 31 sewer lift stations.

Port of Redwood City critical infrastructure owned by the City of Redwood City includes:

- Five concrete Wharves;
- One Administration building;
- One Maintenance building; and,
- One Boat Launch Ramp.

The sewage treatment plant is operated and maintained by the South Bayside System Authority (SBSA), a public entity. The sewage treatment plant is used jointly by the City

with other public agencies, all of which are party to the joint exercise of powers agreement that established SBSA.

Step 4 – Assess Vulnerabilities

The fourth step of the risk assessment and its primary intent is the vulnerability assessment. This section includes an overview of the vulnerability assessment, methodology, data limitations, and exposure analysis.

Overview of a Vulnerability Assessment
The requirements for a risk assessment, as stipulated in DMA 2000 and its implementing regulations, are described below.

- A summary of the community's vulnerability to each hazard that addresses the impact of each hazard on the community;
- An identification of the types and numbers of existing vulnerable buildings, infrastructure, and critical facilities and, if possible, the types and numbers of vulnerable future development; and,
- Estimate of potential dollar losses to vulnerable structures and the methodology used to prepare the estimate.

Methodology
The methodology used to prepare the dollar estimates for vulnerability is described below.

Estimating potential losses/damages from natural hazard events at the City level can be a very difficult task to complete with limited data. As such, the Hazard Mitigation Team relied on detailed hazard event profile mapping (and associated GIS data) from past hazard events. For those natural hazards that are specific to certain parts of the City (e.g., flooding, landslides, and wildfires), the GIS data analysis that was conducted for the asset identification served as the primary means for estimating potential losses from the profiled hazard events.

In addition, The National Flood Insurance Program (NFIP) 100-year flood loss estimates calculated for a number of representative floodplain structures identified throughout the City were used. FEMA's HAZUS loss estimation program was used to calculate approximate earthquake losses for the profiled event throughout the City. A summary of how the potential losses were estimated from the profiled hazard events is provided below.

Potential dollar losses are summarized in Tables 3-4, 3-5, and 3-6 within the exposure analysis section below. A conservative exposure-level analysis was conducted to assess the risks of the identified hazards. This analysis is a simplified assessment of the potential effects of the hazard on values at risk without consideration of probability or level of damage.

Using GIS, the building footprints were compared to locations where hazards are likely to occur. If any portion of a facility fell within a hazard area, it was counted as impacted. Using census block level information, a spatial proportion was used to determine the percentage of the population and residential and nonresidential structures located where hazards are likely to occur.

Replacement values or insurance coverage, obtained by the City using HAZUS-MH, were developed for physical assets; however, they were not calculated for this version of the LHMP. Potential loss estimates may be addressed with future updates of the LHMP.

Data Limitations

The vulnerability estimates provided herein use the best data currently available, and the methodologies applied result in an approximation of risk. These estimates may be used to understand relative risk from hazards and potential losses. However, uncertainties are inherent in any loss estimation methodology, arising in part from incomplete scientific knowledge concerning hazards and their effects on the built environment, as well as approximations and simplifications that are necessary for a comprehensive analysis.

It is also important to note that the quantitative vulnerability assessment results are limited to the exposure of people, buildings, and critical facilities and infrastructure to the hazard. It was beyond the scope of this LHMP to develop a more detailed or comprehensive assessment of risk (including annualized losses, people injured or killed, shelter requirements, loss of facility/system function, and economic losses). Such impacts may be addressed with future updates of the LHMP.

Due to the 2008-2009 economic recession, which has been precipitated by a downturn in the housing market, there is no reasonable way to revise the 2005 values. The values escalated exponentially during the 2005-2007 period, and then substantially declined in the 2008-2009 period. Sales of properties have been reduced, with lower-value properties being sold, while many higher value properties are not going on the market. While property values have dropped in the past two years, the costs of retrofit and repair have not changed. The decision has been made to continue to use the 2005 values in this plan, understanding that these numbers will need to be updated for the 2015 version of this LHMP.

Exposure Analysis

The numbers in this section are an estimate of the 2005 market value of private improvements. The Hazard Mitigation Team created these values only to provide estimates of property at risk in hazard areas. They do not represent scenarios of loss due to hazards, nor do they represent the replacement value (cost of repairing or replacing a structure) that would be damaged or destroyed during a hazard event. In addition, they do not include public and other nontaxable improvements, as assessors do not assess the value of these properties. Finally, they should not be used, by themselves, to compare the relative risk of earthquakes versus fire versus flooding in the City for they do not contain

information on probability of occurrence for the various hazards, or the damage level associated with a particular use or building type given a level of hazard.

Almost all of the assumptions made in this analysis tend to underestimate the number and value of buildings in the City. The single exception is the decision made to use 2005 market value of property, rather than escalating it for a period, and then deflating it due to the 2009 recession. However, every indication is that the cost of labor for contractors has not dropped. Therefore, it is likely that the number of private buildings and actual market value of private improvements in the City is much higher than the values provided in this Plan.

Note that this section analyzes only buildings and their values in the high hazard areas, and makes no comment upon the probability of a hazard occurring in a given high hazard area. The probability of a high hazard area resulting in a disaster varies by hazard.

Earthquake – There is no map of all active faults in the region that accurately describes their locations, as the U.S. Geological Survey has not completed all seismic mapping of the Redwood City jurisdiction. As a substitute, this Plan uses the Alquist-Priolo Fault Rupture Study Zones to determine the threat of fault rupture (See Figure 3-1). High hazard areas for this hazard therefore consist of the area in this Study Zone. These Zones are much wider than the actual fault traces, and therefore the number of buildings and their values in the high hazard areas is overestimated.

Liquefaction Susceptibility – Liquefaction is divided into five categories of increasing liquefaction susceptibility on the USGS Liquefaction Susceptibility Map (Witter and others, 2006). This map is similar to, and an update of, the Knudsen and others map (2000). The three categories of highest liquefaction susceptibility (very high, high, and moderate) are used to define the high hazard areas. In addition, the California Geological Survey (CGS) has mapped portions of San Mateo County. The USGS compilation is used for the analysis in this Plan (See Figure 3-2).

Earthquake-Induced Landslides – Maps showing earthquake-induced landslides were mandated under the Seismic Hazards Mapping Act of 1990. Locations of earthquake-induced landslides within San Mateo County are shown in Figure 3.2.

Flooding – Areas within the 100-year flood zone (including flooding due to wave action) are considered high flood hazard areas as shown in See Figure 3-3.

Wildland-Urban-Interface (WUI) Fire Threat – The high hazard areas are defined as any area within the WUI Threat Zone as described in the WUI Threat maps created by Cal Fire. These hazard areas generally occur on the edge of urban areas. (See Figure 3-8).

The three categories of development analyzed are:

Residential and Mixed-Use – including homes, condominiums, apartments, and mixed-use buildings with commercial on the ground floor.

Commercial and Recreational – including retail, office, recreational, motels/hotels, research and development, and properties with mixed commercial and light industrial buildings.

Industrial and Other – including light and heavy industrial, recycling, warehousing, communications, food processing, and other non-commercial and non-residential uses.

The results of the exposure analysis are summarized in Tables 3-4, 3-5, and 3-6 and in the discussion below. The categories of land use for the properties were obtained from the assessor's land use information for the parcel.

Table 3-4 shows the population and number of residential and nonresidential structures within hazard zones that are vulnerable to hazard impacts. Nonresidential structures include all other buildings such as commercial and industrial.

Table 3-4
Potential Hazard Vulnerability Assessment – Impacted Buildings

Hazard	Methodology	Impacted Buildings	
		Residential	Nonresidential
Earthquakes	High	1,260	48
	Moderate	15,449	1,119
Floods	100-year flood zone	3	9
	500-year flood zone	7,665	557
Landslides	High	39	0
	Moderate	3,262	24
WUI	Within Threat Area	5,774	281

Examining the exposure by development type value (Table 3-5) reveals that residential properties make up the bulk of the exposed value in the City for every hazard. Properties are disproportionately exposed to hazards by comparing the percentage of value in each high hazard area to the overall percentage of value in the region.

Table 3-5
Percentage of Estimated Value of Development in High Hazard Areas by Type

	All Land	Earthquake Shake Potential	Landslide (High & Very High)	Liquefaction (High & Very High)	Flood 500yr	Flood 100yr	WUI Zone
Total Value (Millions)	14,784	13,613	26	8,567	7242	290	5010

Residential	11,000	10,124	26	5,664	5,091	2	3,565
Commercial	2,970	2,895	0	2,306	1,871	281	1,230
Industrial/Other	813	594	0	597	280	7	21

Note: The CGS (California Geological Survey) study zones are larger than fault zones. They are zones in which studies are required in order to ensure that no structures intended for human occupancy are placed across active faults.

Exposed Value of Private Buildings
This estimate includes only taxable properties that the assessor has assessed a value for, and does not include properties that are public or exempt from taxation.

Examining the exposure by number of vulnerable building in the hazard zones (Table 3-6) reveals that residential properties make up the bulk of the exposed buildings for every hazard.

Table 3-6
Estimated Number of Private Buildings in High Hazard Areas by Type

	All Land	**Earthquake Shake Potential (Moderate to Very High)**	**Liquefaction (High to Very High)**	**Landslide**	**Flood 500yr**	**Flood 100yr**	**Wildfire Zone**
Total Number	19,742	17,952	13,805	3525	8,222	12	6,055
Residential		16,759	12,608	3,501	7,665	3	5,774
Commercial		913	758	23	315	8	98
Industrial		280	439	1	242	1	183

The analysis in this section is based on three basic breakdowns:

- Total Number of Buildings Exposed;
- Total Value of Improvements Exposed; and
- Loss Estimates.

Data for insured values of these structures are insufficient to make a consistent estimate of the value of these structures based on insurance claims, although in the area of repetitive loss structures under the National Flood Insurance Program (NFIP), there have been 36 repetitive loss structures (all private structures), with a claim amount of $424,162.00.

Total Number of Buildings Exposed
While the number of buildings is occasionally included in assessor's parcel information, this information is very incomplete and may also be inaccurate, as identifying the number of buildings is not the focus of the assessor's work. Instead, for all parcels where a

positive assessed improvement value indicated that a building was present on the parcel, it was assumed that there was one building per parcel. While this assumption is accurate for most single family homes (which comprise the majority of City development), it is also introduces several sources of error. First, all apartment, condominium, office, and industrial complexes that are considered to be one parcel by the assessor may actually be composed of several buildings. Second, many single-family parcels consist of in-law units or detached garages, which are also separate buildings.

Finally, many condominiums, although they are in one building, are considered to be separate parcels. The first two sources of error (the assumption of one building per parcel) will underestimate the number of buildings exposed to a hazard. The last error can overestimate the number of buildings exposed to a hazard. Overall, the first two sources of error are much more common, meaning that the number of buildings exposed to a hazard is likely to be higher than the statistics presented here.

Total Value of Improvements Exposed

Exposure estimates were created using the assessed value of improvements for every parcel. In California, however, the assessed value of a property is rarely equal to the real market value of the property. Proposition 13, passed in 1978, limits the amount of value that the assessor can claim real property to be worth. Specifically, after a property is sold, the assessor can only raise the assessed value of the property at a maximum of 2% per year, even if the market inflates the value significantly more than 2%. Once the property is sold again, the assessor can use that sales price as the new assessed value. Therefore the assessed value is equal to the real market value only in the year when the property is sold. The longer it has been since the property was sold, the larger discrepancy that will exist between the assessed value and the real market value of the property (with the assessed value generally much lower than the market value). While this is a significant problem for all properties, it is likely an even larger problem for nonresidential properties, which have very low turnover when compared with residential properties.

Loss Estimates – The Next Step

One of the most useful ways to examine risk is to estimate the total losses that might be expected from a variety of hazards over a given period, such as 100 years, or to change those losses to an average annual exposure. The principal use for such estimates is likely to be to determine the costs of not mitigating a hazard to compare against the costs and benefits of hazard mitigation.

To obtain these loss estimates, there must be probability of the event occurring. For example, various earthquake scenarios could have a probability of occurring with the probability of the event resulting in damage to a particular location. In this estimate of loss, the Hazard Mitigation Team chose to replicate the 1906 San Francisco Earthquake scenario (See Table 3-7).

Table 3-7 Assets at Risk – Replication of 1906 San Francisco Earthquake

Assets at Risk (100% loss)	Total Value
Residential Buildings	$11,001,000,000
Commercial Buildings	$ 2,970,000,000
Industrial Buildings	$ 813,000,000
Critical Facilities	
City Hall	$ 11,237,046
Police Department	$ 13,804,080
Fire Station # 9	$ 7,180,028
Fire Station #10	$ 1,384,057
Fire Station #11	$ 3,499,497
Fire Station #12	$ 1,010,999
Fire Station #20	$ 1,314,299
Water System	$ 59,912,251
Storm Drain and Sewer Systems	$ 16,510,486
Community Activities Building	$ 2,215,413
Fair Oaks Community Center	$ 1,078,839
Veteran's Memorial Senior Center and Annex Building	$ 3,400,661
Red Morton Community Center	$ 7,968,229
Port of Redwood City Facilities (Wharves & Building)	$ 11,816,515

Source: City of Redwood City Finance Department
San Mateo County Assessor Office

The above numbers are only an estimate of the 2005 market value of improvements. The Hazard Mitigation Team created these values only to provide estimates of property at risk in hazard areas. They do not represent scenarios of loss due to other hazards, nor do they represent the replacement value (cost of repairing or replacing a structure) that would be damaged or destroyed during a hazard event. In addition, they do not represent public and other nontaxable improvements, as assessors do not assess the value of these properties.

When losses occur, replacement value is a better estimator of actual losses than fair market value. If these market values were converted to replacement values, they would increase for at least two reasons. First, replacement value assumes replacing structures, which typically costs more than the fair market value of the old structure. Second, even in a localized emergency, there are market factors that increase the price of materials and labor further as they are in short supply relative to the demand.

The City conducted an earthquake loss estimate for its water system in 2002. This study examined the seismic performance of the water system due to a San Andreas M 7.9 or Hayward M 7.1 event, representing the two of the most likely worst case earthquake events that can affect the city's water system. The critical findings include the following:

For the water system in its as-is condition, and relying on the Hetch Hetchy system in its as-is condition, water outages in Redwood City vary from 27 to 47 days (San Andreas M 7.9 event) and up to 12 days (Hayward M 7.1 event). Fires that might be ignited in the City may spread into conflagrations, given the damage to the water system, especially if it is windy at the time of the earthquake. To mitigate these severe outages and impacts, a combination of upgrades to parts of the Hetch Hetchy system as well as for pipelines, some reservoirs and some pump stations within Redwood City are required. The City is currently exploring approaches to obtain funding to make such upgrades.

Step 5 – Analysis of Future Development Trends

Redwood City actively works towards creating a community that is workable, has a balanced mix of uses, and fosters economic, environmental, and social sustainability. New approaches to land use planning and development are driven by the connections between land use (and our transportation choices due to the land use patterns) and global warming.

The Redwood City 2009 General Plan Update indicated that the City is expected to experience continued growth over the next 20 years. Growth areas were developed to include a range of services and facilities as well as commercial, residential, institutional and industrial land uses that should accommodate the anticipated growth. The growth areas are focused around areas already developed with existing infrastructure services including sewer, water, highways, police, fire protection, schools, parks and other services.

While any future development will be susceptible to existing hazards, the contents of this LHMP (once adopted) can be incorporated into the comprehensive plan to help ensure less hazard-prone development. In addition, enforcement of local codes and ordinances should minimize vulnerability to flooding and other hazards.

SECTION 4 - MITIGATION STRATEGY

The following provides an overview of the process for preparing a mitigation strategy, including conducting a capability assessment, developing mitigation goals and objectives, identifying and analyzing potential mitigation actions, prioritizing mitigation actions, and implementing a mitigation action plan.

The Hazard Planning Team developed a strategy for mitigating the prioritized hazard risks identified this plan. The mitigation strategy provides the "what, when, and how" of actions that will reduce or possibly remove the community's exposure to hazard risks, and is categorized into the following components:

- •Capability Assessment;
- •Goals and Objectives;
- •Mitigation Actions/Projects; and
- •Implementation Strategy.

Capability Assessment

An important component of the Mitigation Strategy is an understanding of the resources available to the jurisdiction in order to mitigate the effects of each of the identified hazards. The Capability Assessment begins with a review of legal and regulatory capabilities, including ordinances, codes, and plans needed to address hazard mitigation activities. This Assessment also describes the administrative and technical capability available to the agency. The third component of the Assessment is the City's fiscal capability to ensure the availability of financial resources to implement proposed mitigation strategies. The final part of the Capability Assessment is a review of the physical assets available to respond to the emergency needs of the community.

Legal and Regulatory
The City's applicable Building Codes, Zoning Ordinances, Subdivision Regulations, Capital Improvement Plan, and other regulatory development guides provide specific support to hazard mitigation activities within the communities. Additionally, the General Plan, Multi-hazard Emergency Operations Plan, its annexes provide additional authority.

Administrative and Technical
The City has experienced and competent administrative and technical staff in place to expedite the mitigation actions identified. They possess technical expertise in the areas of planning, engineering, floodplain management, Geographic Information Systems (GIS), and both emergency and general management authority. Additionally, technical and administrative resources are available to assist the staff in implementing the hazard mitigation goals.

Financial
In order to achieve the goals and objectives of the Mitigation Strategy, one or more of the following funding sources could be utilized: federal and state entitlements and grants, general fund, sales and property taxes, infrastructure user fees, impact fees, and new development impact fees. The City has the necessary budgetary tools and practices in place to facilitate handling appropriate funds; however funding sources are very limited.

Fire Department
Fire prevention and suppression services are provided by the City of Redwood City Fire Department (RCFD), a fire and emergency service organization. The Department provides fire suppression, emergency medical care, water rescue, entrapment extrication, fire safety inspections of businesses, public fire safety education, fire investigation, and disaster management and planning.

Mitigation Goals and Objectives

The requirements for the local hazard mitigation goals, as stipulated in DMA 2000 and its implementing regulations, are described below.

Team members reviewed the hazard profiles and risk assessment results as a basis for developing mitigation goals and objectives. Mitigation goals are defined as general guidelines that explain what a community wants to achieve in terms of hazard and loss prevention. Goal statements are typically long-range, policy-oriented statements representing community-wide visions. Objectives are statements that detail how a community's goals will be achieved. Typically, objectives define strategies or implementation steps to attain identified goals. Using the Redwood City General Plan 2009 Update as a guideline, the Hazard Mitigation Team developed six goals with associated objectives to reduce or avoid long-term vulnerabilities to the identified hazards. This mitigation planning process was reviewed and refined in January 2010.

Potential Mitigation Actions

In addition to developing goals and objectives, the Hazard Mitigation Team identified potential mitigation actions that will assist the City in mitigating the impact of natural hazards. Mitigation actions are activities, measures, or projects that help achieve the goals and objectives of a mitigation plan. Mitigation actions are usually grouped into six broad categories: prevention, property protection, public education and awareness, natural resource protection, emergency services, and structural projects.

The Hazard Mitigation Team reviewed the City's hazard mitigation risk assessment as a basis for developing potential mitigation actions. In addition, particular emphasis was placed on actions that reduced the effects of hazards on both new and existing buildings and infrastructure.

Some mitigation actions have already been implemented and have actively involved the public. In September, 2009, Redwood City shared its plan for the Redwood Shores levee improvement project with the community. Those improvements were needed to meet levee certification requirements of the Federal Emergency Management Administration (FEMA), in order to prevent the imposition of mandatory flood insurance for Redwood Shores residents.

The key structural elements and necessary levee elevation have been completed, and the City is moving forward with certification to meet FEMA's flood zone map deadline, as well as cleanup and restoration of the paths atop the levees.

A 400-foot portion of that levee segment is within the Federal Aviation Administration's (FAA) protected runway safety zone and cannot be built-up due to aircraft landing safety regulations at the San carlos Airport, which is adjacent to the Redwood Shores Area. However, our proposed solution is to use a temporary structure, such as an inflatable bladder, that will deploy only during imminent flood conditions. This would have the effect of temporarily raising the height of that segment of levee, thus completing the flood protection system. During the period the structure is deployed, the airport would have to be closed to comply with FAA regulations.
County airport staff will be coordinating with the FAA to modify airport operations protocols. Parallel to that effort, the City's project team is in discussion with FEMA regarding acceptance of this solution.

FEMA periodically updates its FIRMs. These maps determine whether an area is considered to be in a flood plain, and therefore may require homeowners in such areas to obtain flood insurance. FEMA is now in the process of updating those maps for San Mateo County for the first time since 1982.

Redwood City and our neigh boring communities of Foster City, San Mateo, Belmont, San Carlos, and portions of unincorporated San Mateo County all have areas adjacent to San Francisco Bay that FEMA is studying. Key to FEMA's study is the certification of the system of levees that protect these areas. Certification is established on a levee's integrity, based on its height, width, and stability.

The vast majority of the City's levees are in generally good condition and we will be able to certify these levees for FEMA. There are two levees that are currently exceptions, and both may have an effect on Redwood Shores. One is the levee around "The Preserve at Redwood Shores" upcoming development. As part of that development, this segment of levee is scheduled to be improved this summer (2010) to certification standard, and the City has been notified by FEMA it will give it provisional accreditation.

The other levee of concern is adjacent to the County airport, at Steinberger Slough. This levee is actually on County-owned land, with different levee sections within either San Carlos or Redwood City. Due to levee height issues related to the proximity of the San Carlos Airport, there is the potential for Bay water to enter the peninsula at this point. If

that were to happen, flood waters would likely enter the Redwood Shores community. It is this aspect that FEMA may use to determine that Redwood Shores is in a flood plain and thereby require flood insurance.

City staff has been working with FEMA over the past year toward excluding the Redwood Shores peninsula from being classified as flood plain, and is also meeting with representatives of San Mateo County to come up with a viable solution. Although the County has no current budget to improve this levee, City staff is exploring the possibility of building a new interior levee at the Redwood City limit line to cut off the bay water in the event the existing levee fails.
I
FEMA issued the preliminary flood map for San Mateo County on April 18, 2009, which classifies Redwood Shores as flood plain. This map is not final and the City is working more intensively with FEMA to have the flood designation modified. The Effective Map Date is anticipated to be spring of 2010.

Even if flood insurance turns out not to be required, FEMA still suggests that it be purchased if feasible. Flood insurance is sold by insurance agents, but is administered by FEMA so the pricing is set. Still, the pricing structure is very complicated; and the City has kept the community abreast of the information as this process moves forward. It is the intent of the City to continue compliance with the National Flood Insurance Program.

Prioritizing and Implementing Potential Mitigation Actions

The DMA 2000 requires the evaluation, selection, and prioritization of the potential mitigation actions, as described below.

The Hazard Mitigation Team reviewed the following questions to help identify the actions that would best help the City fulfill its mitigation goals and objectives, thereby reducing or avoiding long-term vulnerabilities to the identified hazards.

- Does the action mitigate assets identified as vulnerable in the LHMP's Risk Assessment?
- Is the action economically feasible (either through a grant or current funding sources)?
- Are proper laws, ordinances, and resolutions in place to implement the action?
- Is political and public support enough to implement the action and ensure its success?

Through this process, the Hazard Mitigation Team identified 23 mitigation actions to be included in the LHMP action plan. Once selected, the Hazard Mitigation Team prioritized the actions based on a ranking system of high, medium, and low. The following considerations for this ranking process included:

- Benefits versus costs;

- Ease of implementation;
- Multi-objective actions; and
- Time.

Additionally, the Hazard Mitigation Team identified how the action will be implemented and administered, including which departments or agencies would be responsible, existing and potential funding sources, and time frame.

Listed below are the City's specific hazard mitigation goals and objectives as well as related potential actions. For each goal, one or more objectives have been identified that provide strategies to attain the goal. Where appropriate, the City has identified a range of specific actions to achieve the objective and goal.

Goal 1. Promote Disaster-Resistant Development.
Priority: 1
Responsible Agency: Fire Department
Supporting Agency: Building, Infrastructure and Transportation Department

Objective 1.A Ensure that local plans, policies, and programs are consistent with the hazard information identified in the LHMP.

Action 1.A. Review the General Plan Public Safety Element, Municipal Code, Zoning Regulations, hazard area maps, and LHMP implementation strategies for consistency with each other.

Objective 1.B. Educate City employees to increase their awareness of hazards, emergency response, and recovery.

Action 1 .B.1 Train fire fighters, police officers, building inspectors, public works, community development, construction and inspection and parks and recreation staff to levels appropriate for their hazard mitigation tasks and responsibilities.

Action 1.B.2 Provide training for City staff who apply its building regulations and planning standards, emphasizing the lessons learned in locations that have experienced disasters.

Action 1.B.3 Conduct disaster-preparedness exercises for the types of hazards discussed in this LHMP.

Action 1.B.4 Apply training to City staff to deal with emergencies and to levels appropriate for their hazard mitigation tasks and responsibilities.

Objective 1 .C Pursue available grant funding to implement mitigation measures.

Action 1.C.1 Review FEMA grant applications and establish internal procedures to streamline the application process.

Action 1.C.2 Apply for grants to fund mitigation actions identified in the LHMP.

Goal 2. Promote Public and City Awareness To Prepare For, Respond To, And Recover From Natural Hazards.
Priority: 2
Responsible Agency: Fire Department
Supporting Agency: Public Information Officer

Objective 2.A Educate the public to increase their awareness of hazards, emergency response, and recovery.

Action 2.A.1 Establish a budget and identify funding sources for mitigation outreach.

Action 2.A.2 Support the efforts and education of people with disabilities to prepare for disasters.

Action 2.A.3 Distribute appropriate public information about hazard mitigation programs and projects at City-sponsored events.

Action 2.A.4 Train citizens to deal with emergencies at times when professional responders would be overwhelmed.

Goal 3. Reduce The Possibility Of Damage And Losses Due To Earthquakes.
Priority: 3
Responsible Agency: Building, Infrastructure & Transportation Department
Supporting Agency: Planning, Housing and Economic Department

Objective 3.A Protect existing assets, as well as any future development, from the effects of earthquakes.

Action. 3.A.1 Continue to enforce the Uniform Building Code provisions pertaining to grading and construction relative to seismic hazards.

Action 3.A.2 Continue to enforce Uniform Building Code requirements for addressing liquefaction potential in the design of structures.

Action 3.A.3 The water department will examine its existing infrastructure, identify sources of potential funding to upgrade its older facilities, and install

new infrastructure to the latest seismic standards. Replacement of non-seismically-designed water-system infrastructure and pipelines may take well over one hundred years to accomplish, leaving the city potentially very vulnerable to a loss of water supply in a large earthquake for the next several decades future until new sources of mitigation funds are identified and retrofits completed.

Goal 4. Reduce The Possibility Of Damage And Losses Due To Floods.
Priority: 4
Responsible Agency: Building, Infrastructure & Transportation Department
Supporting Agency: Public Works Department

Objective 4.A Protect existing assets and new development from floods.

Action 4.A.1	Develop and carry out environmentally sensitive flood reduction programs.
Action 4.A.2	Require engineered floodplain and hydrologic analysis to be prepared for new development projects within or directly adjacent to 100-year floodplains.
Action 4.A.3	Limit uses in floodways to those tolerant of occasional flooding, including but not limited to outdoor recreation and natural resource areas.
Action 4.A.4	Continue upgrade of levees in the Redwood Shores area.

Goal 5. Reduce The Possibility Of Damage And Losses Due To Landslides.
Priority: 5
Responsible Agency: Building, Infrastructure & Transportation Department
Supporting Agency: Public Works Department

Objective 5.A Protect existing assets, as well as new development, from landslides.

Action 5.A.1	Require construction and/or maintenance of natural and/or human-made retaining structures that will help control landslide risk in key residential and/or commercial areas.
Action 5.A.2	Require retrofit or implement stabilizing measures for hillside developments within

moderate to high landslide areas that predate current best practices and codes.

Action 5.A.3 Require any development proposed in an area of moderate or high landslide potential to be subject to review and recommendation by a State-registered engineering geologist.

Goal 6. Reduce The Possibility Of Damage And Losses Due To Wildland Fires.
Priority: 6
Responsible Agency: Fire Department
Supporting Agency: Public Works Department; Building, Infrastructure & Transportation Department

Objective 6.A Protect existing assets, as well as new development, from wildland fires.

Action 6.A.1 Maintain the California defensible space ordinance (Gov. Code 51182 and California Building Code 7a) which requires that buildings that are within areas of moderate fire hazard areas and which are close to areas of high or extreme fire hazard areas shall maintain 100' of defensible space (or the distance to the property line, whichever is closer) and have noncombustible exteriors.

Action 6.A.2 Continue to conduct current fuel management programs and investigate and apply new and emerging fuel management techniques.

Action 6.A.3 Continue to require an enhanced fire protection plan in high or extreme wildland fire hazard areas.

Prioritization of Mitigation Actions

The Mitigation actions were prioritized based upon, 1) overall life threat, 2) the STAPLE+E criteria which factor into account the social, technical, administrative, political, legal, economic and environmental concerns, and 3) a cost-benefit review of prioritized actions. Key stakeholders utilized these criteria to establish ratings of HIGH, MEDIUM and LOW for each mitigation action.

Implementation Strategy

Once the LHMP has received formal adoption by the City, the following action plan, agreed upon by the Hazard Mitigation Team members, will be used to ensure the Plan is

fully implemented and remains an active and relevant document: It is also the City's strategy to integrate these actions into existing planning documents and projects, such as the City General Plan (currently being updated), and the City Capital Improvement Project (CIP). With this integration, projects to implement mitigation actions will result in detailed cost-benefit analyses to further refine projects parameters and validate prioritization strategies. This will remain an ongoing effort and ensure this LHMP remains a living document that will be maintained in accordance with Section 5 of this LHMP.

Table 4-1 Implementation Strategy

Mitigation Action		**Implementation Strategy**			
ID	**Name**	**Responsible Department**	**Funding Sources**	**Completion Date**	**Priority**
1.A	Ensure Plan Consistency	Fire Department	General Plan/DHS Grants	Annual	High
1.B	Educate City employees	Fire Department	General Plan/DHS Grants	Annual	High
1.C	Obtain Mitigation Grant Funding	Fire Department	General Plan	Annual	Medium
2.A	Educate the public to increase their awareness of hazards, emergency response, and recovery	Fire Department	General Plan/DHS Grants	Annual	High
3.A	Protect existing assets, as well as any future development, from the effects of earthquakes	Building, Infrastructure & Transportation Department	General Plan/DHS Grants	Ongoing	High
4.A	Protect existing assets and new development from floods	Building, Infrastructure & Transportation Department	General Plan/DHS Grants	Ongoing	High
5.A	Protect existing assets, as well as new development, from landslides	Building, Infrastructure & Transportation Department	General Plan/DHS Grants	Ongoing	High
6.A	Protect existing assets, as well as new development, from wildland fires.	Fire Department	General Plan/DHS Grants	Ongoing	High

SECTION 5 – PLAN MAINTENANCE PROCESS

This section describes a formal plan maintenance process to ensure that the LHMP remains an active and applicable document. It includes an explanation of how the City and the Hazard Mitigation Team intend to organize their efforts to ensure that improvements and revisions to the LHMP occur in a well-managed, efficient, and coordinated manner.

The following three process steps are addressed in detail below:

- Monitoring, evaluating, and updating the LHMP;
- Implementation through existing planning mechanisms; and,
- Continued public involvement.

Monitoring, Evaluating, and Updating the LHMP

The requirements for monitoring, evaluating, and updating the LHMP, as stipulated in DMA 2000 and its implementing regulations, are described below.

The City's Disaster Advisory Committee will be responsible for monitoring, evaluating, and updating the LHMP. This committee is comprised of the Fire Chief and representatives of the police, public works, utilities, and administration departments. In addition to the Disaster Advisory Committee, other interested parties, including members of the Hazard Mitigation Team, City Council, Planning Commission, and any other department representative, can be responsible for implementing the LHMP's action plan. The Fire Chief and Fire Department will serve as the primary point of contact and will coordinate all local efforts to monitor, evaluate, and revise the LHMP.

The Disaster Advisory Committee will monitor progress made within the LHMP by conducting a review of the progress in implementing the LHMP, particularly the action plan, on an annual basis. The annual review will provide the basis for possible changes in the LHMP's action plan by refocusing on new or more threatening hazards, adjusting to changes to or increases in resource allocations, and engaging additional support for the LHMP implementation. The Fire Chief and Fire Department will initiate the annual review one month prior to the date of adoption. The findings from this review will be presented annually to the City Council. The review will include an evaluation of the following:

- Notable changes in the City's risk of natural or human-caused hazards;
- Impacts of land development activities and related programs on hazard mitigation;
- Progress made with the LHMP action plan (identify problems and suggest improvements as necessary); and
- The adequacy of resources for implementation of the LHMP; and

- Participation of City agencies and others in the LHMP implementation.

In addition to the annual review, the Disaster Advisory Committee will update the LHMP every five years. To ensure that this update occurs, in the fourth year (2014) following adoption of the LHMP, the Disaster Advisory Committee will undertake the following activities:

- Thoroughly analyze and update the City's risk of natural and human-made hazards;
- Provide a new annual review (as noted above), plus a review of the three previous annual reports;
- Provide a detailed review and revision of the mitigation strategy;
- Prepare a new action plan with prioritized actions, responsible parties, and resources;
- Prepare a new draft LHMP and submit it to City Council for adoption; and,
- Submit an updated LHMP to CalEMA for approval.

The plan will be maintained in a three-ring binder with a checklist to indicate changes made and persons making the changes.

Implementation Through Existing Planning Mechanisms

The requirements for implementation through existing planning mechanisms, as stipulated in DMA 2000 and its implementing regulations, are described below.

After the adoption of the LHMP, the Disaster Advisory Committee will ensure that the LHMP, in particular the action plan, is incorporated into existing planning mechanisms. The Disaster Advisory Committee will achieve this incorporation by undertaking the following activities:

- Review the General Plan Safety Element and ensure that it is consistent with the risk assessment and action plan in the LHMP, and update, if necessary;
- Incorporate mitigation actions into the City Capital Improvement Plan (CIP) wherever feasible and cost effective;
- Review the hazard assessment studies and emergency response plans of utilities and of transportation agencies and companies operating in the area, and update the City's Emergency Operations Plan, including evacuation routes, as necessary;
- Work with other area agencies to expand and keep current safety-related information. The City will use sufficiently detailed analysis of hazards, and will update the City's Emergency Operations Plan as new information becomes available; and,

- Keep current and implement its Emergency Operations Plan as required by the California Emergency Services Act.

Follow-up actions will include coordination meetings with the City's Public Works, Community Development and Finance/IT Departments to ensure inclusion of mitigation strategies into ongoing City processes. These processes include City efforts from building standards to public works projects to the Capital Improvement Program. These coordination meetings will be facilitated by the Fire Department and will occur within 90 days of the report's adoption by the City Council.

Continued Public Involvement

The requirements for continued public involvement, as stipulated in DMA 2000 and its implementing regulations, are described below.

The City is dedicated to involving the public directly in the continual reshaping and updating of the LHMP. Hard copies of the LHMP will be provided to each department. In addition, a downloadable copy of the plan and any proposed changes will be posted on the City's Web site. This site will also contain an e-mail address and phone number to which people can direct their comments or concerns.

The Disaster Advisory Committee will also identify opportunities to raise community awareness about the LHMP and the City's hazards. This effort could include attendance and provision of materials at City-sponsored events. Any public comments received regarding the LHMP will be collected by the Fire Department, included in the annual report to the City Council, and considered during future LHMP updates.

SECTION 6 – REFERENCES

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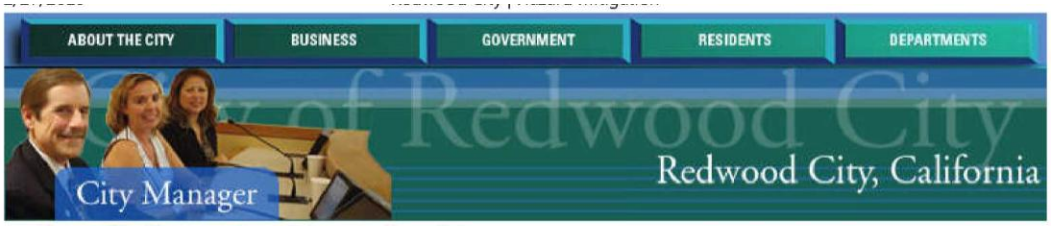
APPENDIX 1 CITY COUNCIL RESOLUTION

APPENDIX 2 PUBLIC INVOLVEMENT SNAPSHOT



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For Immediate Release

Redwood City Fire Department Preparing "Hazard Mitigation Plan"- Community Invited to Review, Discuss Draft

Redwood City, CA - January 5, 2010 - The federal Disaster Mitigation Act (DMA) of 2000 requires that cities have an approved Hazard Mitigation Plan to make them eligible for hazard mitigation funding. In general, hazard mitigation is defined as taking action before a disaster strikes to prevent the occurrence of the disaster, or to reduce the effects of the disaster when it does occur. Such a plan generally focuses on long-term improvements and protection of roadways, hospitals, public safety buildings, and other critical infrastructure and communication facilities that are at risk of failure during a disaster. The plan is used to make a community more resilient to inevitable hazards, and to maintain critical functions on which the community depends.

As part of Redwood City's Local Hazard Mitigation Planning (LHMP) process, the City is responsible for identifying and analyzing potential hazards to the community – including earthquake, flood, fire, and terrorism - and developing appropriate hazard mitigation strategies to address the potential for those hazards occurring. The City's process for developing its Hazard Mitigation Plan includes participation by the community in a workshop to introduce, review, discuss, and obtain community input on the draft plan.

The community is invited to participate in this review and input process:

- **Thursday, January 7, 2010, 7 pm**
  Council Chambers at City Hall
  1017 Middlefield Road

At this workshop the Draft Plan will be introduced in a presentation by the City's consultants, followed by a question-and-answer period. Following this workshop will be a 30-day public comment period during which the community has a further opportunity to review and comment on the plan and the mitigation strategies recommended in the plan to deal with the identified hazards. The Draft Plan will be available online as of Monday, January 11, 2010. A second community workshop on the Hazard Mitigation Plan is planned for February.

This is an important step in emergency preparedness and hazard mitigation for Redwood City, and the community's review, input, and ideas are very welcome in the process of developing the Hazard Mitigation Plan. More information on Hazard Mitigation is available on the FEMA website at http://www.fema.gov/government/mitigation.shtm.

Visit Redwood City's award-winning website at www.redwoodcity.org for information about the City and its services, the community, recreation programs, education, and local business. Subscribe to Redwood City's email newsletter or other documents by visiting www.redwoodcity.org/egov.

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